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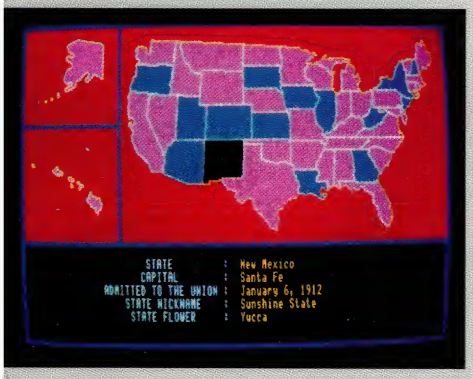
Issue No. 10

SEXTANT®

The Independent Magazine for the Entire Zenith Computer Community and Users of Zenith-Compatible Computers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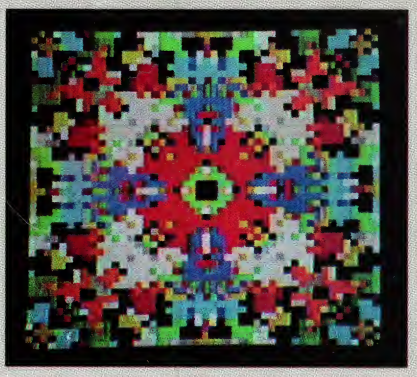

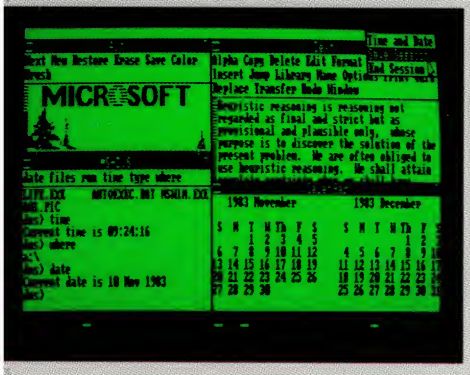
MICROSOFT
Heuristic reasoning is reasoning not regarded as final and strict but as provisional and plausible only, whose purpose is to discover the solution of the present problem. We are often obliged to use heuristic reasoning. We shall attain

Microsoft Windows Opens the Door to MS-DOS/PC-DOS/ Z-DOS Compatibility

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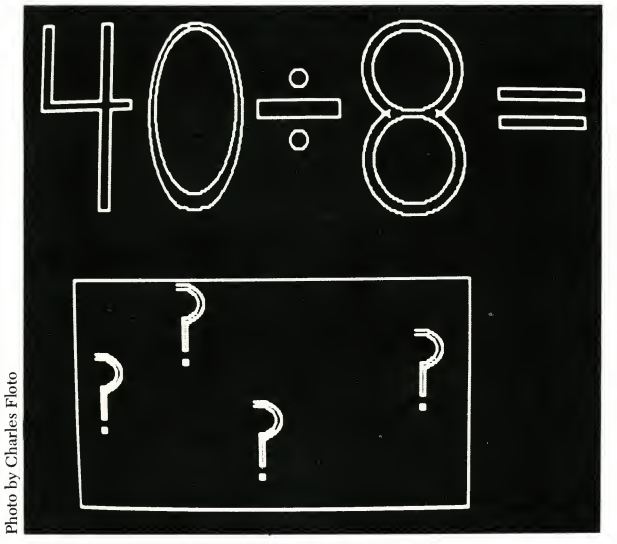

Photo by Charles Floto

43

One of the major reasons for an individual to purchase a microcomputer is to *learn.* But your computer can teach you about a lot more than just computers. You can buy software to help you learn a foreign language or how to type; to help your kids learn math or geography. Some programs are games and meant to be entertaining as well as educational; some are strictly business. Some are for teachers; most are for learners. All of the ones here run on Heath/Zenith computers.

Features

Windows Opens the Door to Compatibility
Frederick Zimmerman 9
The latest addition to the Microsoft Disk Operating System lets you look at more than one program at a time. And now MS-DOS will be able to handle high-resolution graphics on any MS-DOS computer running Windows. That little detail means a lot to programmers writing graphics programs. They won't have to write hardware-specific code. With Windows, when they want a program to run on any MS-DOS machine (such as the Z100), they can write it to run on all MS-DOS machines.

Color Graphics for Your '8 or '89
Ralph W. Boyd 15

Forming a Local HUG
Herbert A. Friedman 25
A local Heath Users' Group is one of your best sources of advice, expertise, and "computer socializing." For those of you who don't have one nearby, here's the story of how a successful HUG was formed in southern California. If you already have one up and running, you might want to look in on how another group handles things.

Turn Your Computer into an Electronic Typewriter
Thomas G. Bohon 30
Do you really need a $300 word-processing program to write a nasty letter to your Congressperson? Or even a $100 package? Or do the kids need one to write a thank-you note for Aunt Harriet's birthday gift? Hardly. For 40 lines of Benton Harbor BASIC you can type your letter, proof it, and address the envelope. (Both disk and cassette versions, too.)

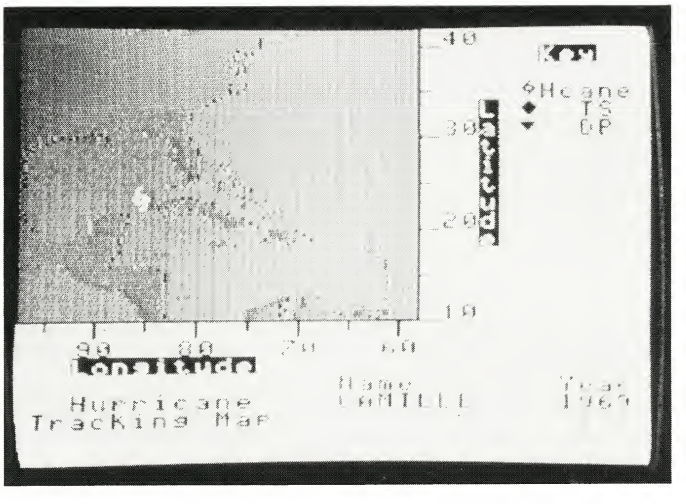

Photo by Ralph Boyd (Hurricane Tracking)

15

If you want color and really good graphics on your '8 or '89, you have to add a graphics board. Then you have to get software that can exploit that board's potential. Here's a survey of the add-on boards for the H8 and H/Z89. And here's a look at some games that require them—and software that will help you write programs, yourself.

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May-June 1984

Put an Electronic Disk into Your H8 33
Thomas R. Sear
The H8 is one of the most durable micros around—and Trionyx Electronics is an important factor in that durability. One of their recent add-on boards is the X/2-H8. It lets you CACHE programs for instant recall. It can also give you a super-fast "electronic disk" holding up to 192K of files.

Doctor Your Daisywheel Device Driver 37
Charles E. Cohn
The Diablo is one of the most popular letter-quality printers. And a lot of others emulate it. In using his Diablo, our author found some annoying traits in the HDOS device driver for it—like starting work by spitting out a whole sheet of paper even when the paper was already at top-of-form. If you have similar problems, you'll want to take a look at his improvements to HDOS's Diablo driver—even if you have a different kind of printer.

Educational Software Roundup 43
Frederick Zimmerman

Classy Bar Graphs 55
Robert W. Rasch

Graphics Algorithm Optimized for 8080 or Z80 63
David Troendle
Really spiffy computer graphics are frequently slow. They needn't be, though. The concepts on which a program is based can be logically simple—and enhance speed at the same time. You can find out why and how from one of the folks who first brought sophisticated graphics capability to Heath/Zenith computers.

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Cover Photos:
States Quiz/Demo by Charles Floto
Microsoft Windows courtesy of Microsoft Corporation
Color graphics by Ralph Boyd

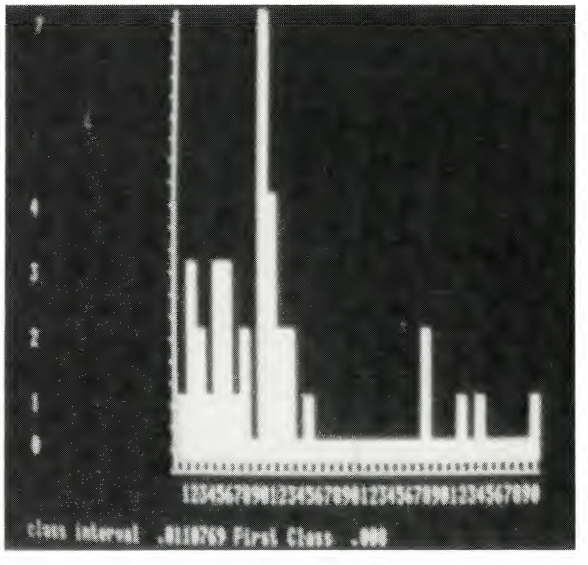
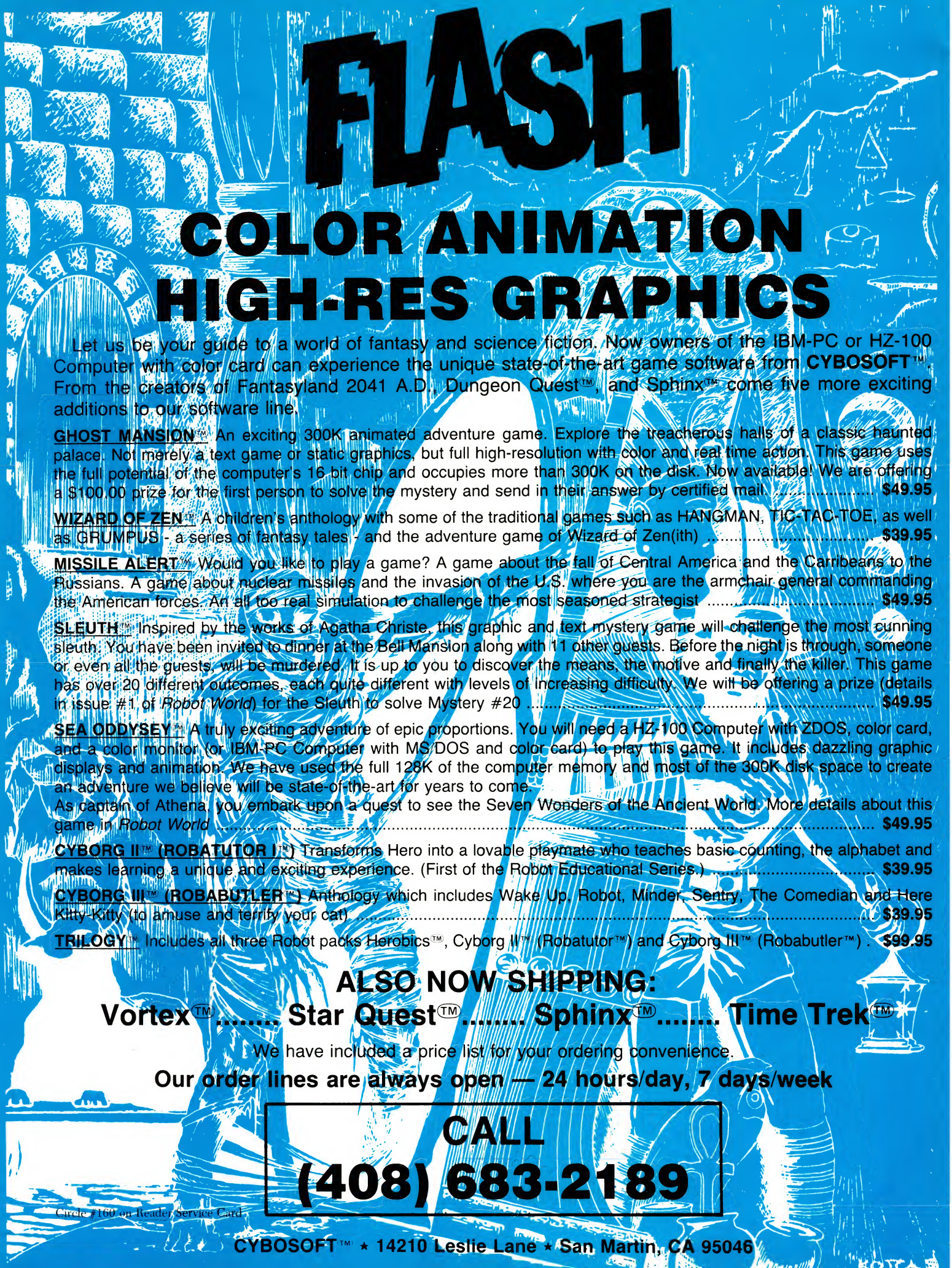


Photo by Charles Floto

55 A good bar graph sums up information. In doing so, it can point out relationships that might otherwise be overlooked. That can take a lot of work, though—unless you have a program to do it for you. This one's in Microsoft BASIC.

Cartoon courtesy of Robert J. Brady Co.

79 Batch files can provide a script to direct the operations of your H/Z110, '120, '150, or '160.



FLASH

COLOR ANIMATION HIGH-RES GRAPHICS

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As captain of Athena, you embark upon a quest to see the Seven Wonders of the Ancient World. More details about this game in *Robot World* **$49.95**

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The Editorial Eye

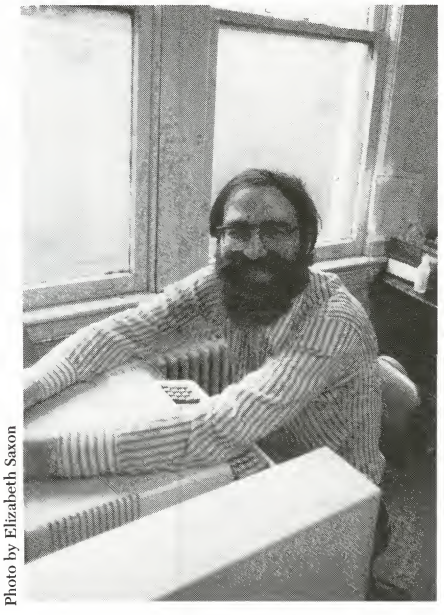


Photo by Elizabeth Saxon

I've been covering the growth of the Heath computer family since 1977. The next few months may be the most difficult in the past seven years. On February 22, Zenith Data Systems announced two new products compatible with the IBM Personal Computer. The desktop Z150 and transportable Z160 are initially no more compatible with Zenith's earlier products than IBM's PC has been. The differences were described last issue in Graham Wideman's discussion: "Why Won't All That IBM-PC Software Run on My Z100?"

A computer vendor's new product introductions often present a shock to its existing customers. Two years ago, there were Z89 users who felt that machine should have been enhanced further. They resented the decision to devote the resources of Zenith Data Systems to development of the Z110 and Z120.

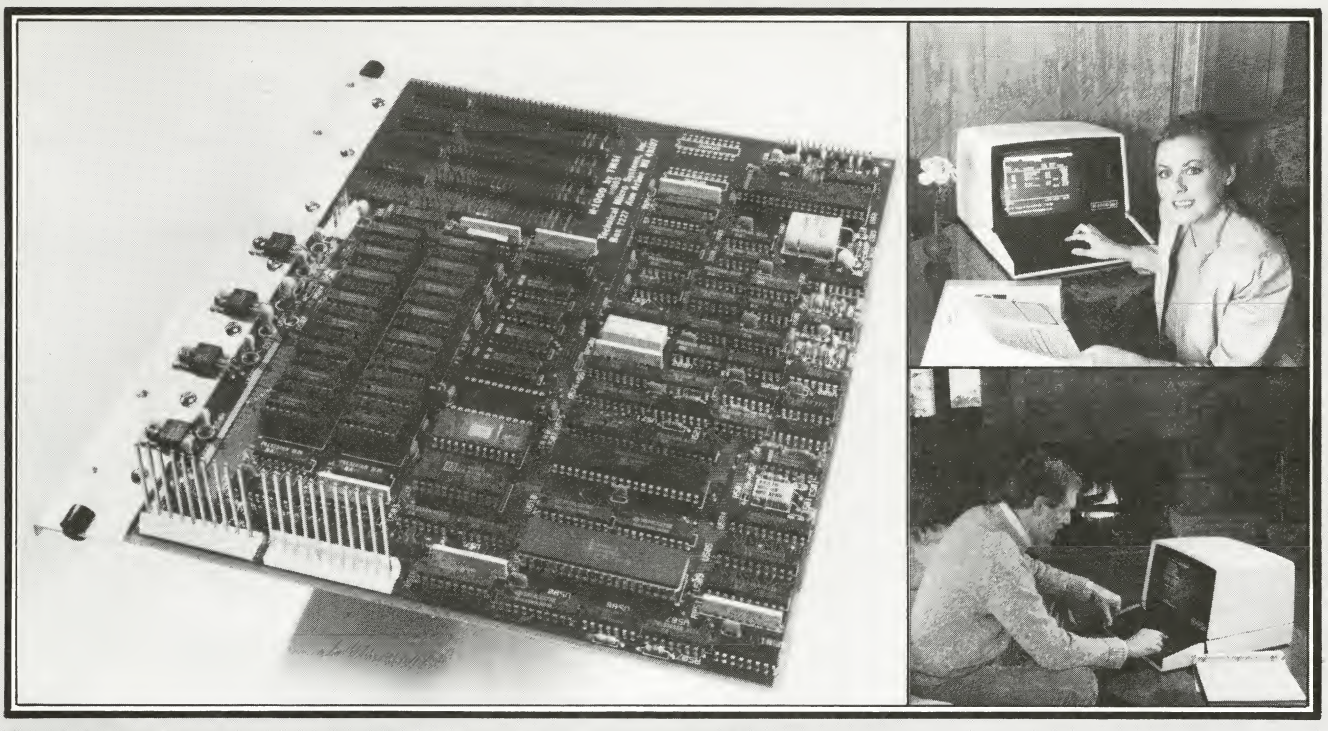
Most Z89 owners, however, were prepared to recognize that the new products represented a real advancement, with their larger memory capacity, faster processor speed, and superior graphics support. Moreover, there was significant compatibility between the new and existing products. One of the new computer's dual microprocessors could run much existing Heath/Zenith software. The '110 and '120 emulated the functions of the H/Z19 terminal so familiar to users of the H8 and H/Z89 computers. They included as standard equipment a controller for both 8″ floppy disk drives and 5.25″ soft-sector floppies—two data storage options available to '8 and '89 users.

This time, however, ZDS's new products are admitted to offer less versatility than its existing computers. For the present, they also have few elements of compatibility. But two coming products promise to improve this situation. One—so far only a rumor—would give the Z150 and Z160 the same high-resolution graphics as the '110 and '120. The major element of compatibility between the new and existing computers will arrive when they all can run Microsoft's Windows extension to its disk operating system. As Fred Zimmerman explains in this issue, "Windows Opens the Door to Compatibility" between scores of computer models and a body of software that promises to be one of the largest available.

More immediately, '110 and '120 users have available a number of software products aimed at the general MS-DOS marketplace. Several of these are sold with an 'installation' program capable of customizing them for the keyboard and high-resolution graphics of the '110 and '120.

Zenith Data Systems has promised continued support for the '110 and '120. Many users of these systems will be more comfortable when these promises are reflected in available software products. Z-DOS version 2 and Microsoft Windows should be especially high priorities for early release.

Charles Floto



You can be a performance leader in business or at home with the H-1000.

Great News for Heath & Zenith Owners!

A Z80/8086 Upgrade for the H89/Z89

The H-1000 is a plug in replacement for your present CPU board, giving you twice the speed, twice the I/O capacity and four times the memory. Yet it's totally compatible with all your present H89/Z89 hardware and software. Best of all, we've added the 8086, a true 16-bit CPU for the high performance software of the 80's. You get compatibility with such machines as Zenith Z-100 and IBM PC at a fraction of the cost of a new system.

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Compare this performance leader to other systems. We think TMSI gives you your best choice.

COMPATIBILITY CHART

	8/16 BIT SYSTEM	16 BIT SYSTEM	8 BIT SYSTEMS		8/16 BIT SYSTEM
	Z100	IBM PC	H89/Z89	DG SUPER 89	H-1000
Runs Z80 and 8080 code	no	no	yes	yes	yes
HDOS 2.0 compatible	no	no	yes	yes	yes
CP/M compatible	yes	no	yes	yes	yes
Runs all H89/Z89 software	no	no	yes	yes	yes
Supports all H89/Z89 hardware	no	no	yes	yes	yes
8-bit clock	5MHz	none	2MHz	4MHz	2/4MHz
16-bit clock	5MHz	4.7MHz	none	none	8MHz
Maximum memory	756k	756k	64k	256k	1048k
Runs MS—DOS and CP/M-86	yes	yes	no	no	yes
color graphics	yes	yes	no	no	no
price/performance	ouch	ouch	good	better	best

Complete systems as well as the H-1000 board are available. For more information and dealer listings, call or write NOW. Dealer inquiries invited.

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Letters

99G Not the Only Way to Get Around

In the [Winter 1984] issue of *Sextant*, page 43, you had some nice things to tell about the MPI 99G. But also some negative about the H25.

I think you could get the H25 to work faster than the 99G if you let dBASE II sort down the addresses to a file on a disk—floppy or hard. And that doesn't take much time. Then if you let a spooler take care of the rest you can even use the computer "all" the time.

And the problem with the small form length is taken care of by UD.DVD or UD.COM, which makes it possible to decide the number of lines to print or to skip.

So I don't think your way is the only way to get around . . .

Bengt Thorson, M.D.
Fritsla, Sweden

Notes from Germany

I wish that I would have known about the survey of military users of H/Z computers that was conducted (*Sextant* #8, Winter 1984), but somewhere along the line I missed out on hearing about it. Oh, well, maybe next time. Actually I've been meaning to write this letter since the first article came out concerning moving a computer through military movers. About a year ago I was transferred from Ft. Lewis, Washington, to Germany and was somewhat apprehensive about shipping my H89. I finally decided that storing it for three years would be much worse than shipping it and having it destroyed, so I boxed it up. Before I boxed it up, though, I reread David Esche's article (issue #2) to see if I'd missed anything. The only thing that I did that he didn't mention was that I put the whole computer into a large, heavy-duty plastic bag so that if anything was knocked loose, it wouldn't get mixed in with the packing. Anyway, it worked like a champ except for two of the foam mounts for the monitor getting broken, but some super glue fixed that. Otherwise, everything worked out fine when I turned on the power.

As a point of information for others here in Germany, the Heath/Zenith store in Dreieich (just south of Frankfurt) no longer sells *or* services Heath products. They do still sell (and service, I guess) Zenith products. The only place in West Germany that now services Heath products is:

CP/D Jansen & Nossler oHG
Vulkanstrasse 13
4000 Dusseldorf
Telephone 0211–784278

Whether or not they sell Heath products I do not know. I was provided the address and phone number by the people at the Dreieich store when I went out there to get a voltmeter repaired.

As far as active HUGs over here, I haven't been able to locate one. I contacted the people at the Dreieich store in reference to the German group and was told that they (the store) didn't have time to sponsor the group and that it was largely inactive. I contacted the only other person I had a name or address for in regards to the American HUG and was told that, again, the group was largely inactive and was asked if he could call me back later in the day. I never received a call so I gathered that the group really was inactive! If anyone is interested in trying to form a group of some sort over here please get in touch with me at either my mailing address below or at my unit, B Company, 503d Aviation Battalion, or by calling me at home 0611–56–53–03 here in Frankfurt.

CW3 Tom Putnam
USACAE, Box 49
APO New York, 09710

A Lower-Budget Alternative

Wayne Rash, Jr. points out in his article "Adding 16K Memory to the '89—A Low-Budget Alternative" in *Sextant*, Winter 1984, a nice way to get the extra memory up and running. There is no cause for criticism of that story but the editorial comment on the Index page places an undeserved accolade on the work.

Specifically, you should not have used the superlative in "the most inexpensive way to take your RAM from 48K to 64K" line. Steve Howard in *Microcomputing*, August-'82, and a letter to the editor in November, details a simpler and less expensive memory expansion procedure. The only costs involved in his scheme are for eight 4116 chips and a few inches of wire. That's 23 fewer components than Wayne uses!

So to Steve go the kudos for the "most"; and to you, chidings for exuberance.

P.E. Gustafson
Belmont, MA

Messenger III Even Better

It was indeed interesting to read Gordon Nichols' article on the SCM TP-I daisywheel printer in issue #8 of *Sextant*.

I wonder whether readers are aware of the new "electronic typewriters" that have recently come on the market, notably the Memory Messenger III by SCM? I came across this machine, and many others, on a recent pass through a local catalog show room. A close look at the Messenger III shows that the daisywheel printer mechanism appears to be similar (if not the same) as the one in the TP-I! It comes with a plug in the rear for a computer interface. How interesting!

The computer interface has both serial and parallel interface input plugs; the serial is RS-232C and the parallel is "Centronics." The ad sheet states that it can be hooked up as a daisywheel printer with most any present-day computers using popular word-processor software. My, my, how *very* interesting! And the price is about half that of the TP-I, and you get a typewriter (it has a full keyboard) to boot! When I discovered it was on sale, I just couldn't resist. I bought one, with the computer interface! Call it "weak-kneed" impulse buying!

A little hardware "fooling around"—and the Memory Correct III Messenger electronic daisywheel typewriter was up and running. Plugged it into the same port as my venerable old Epson MX-80 and away she went! Types beautifully with no major problems other than the text editor (CP/M ED) will not key the SCM's special function codes. This letter was typed on the H19, disk-filed, and PRINTed on the SCM. (I still use my venerable old 64K H8 here!)

I can vouch that the SCM Electronic Typewriter will work fine with the H89 (or Z100 for that matter) and recommend it for personal home use at much lower cost than the TP-I! Don't misunderstand—the TP-I (and TP-II) is a fine printer also, but its price and end-use suggest that it is better suited for business or office. In case anyone wonders, the SCM Electronic Typewriter uses the same typewheels as the TP-I!

Just think of the beautiful job you can do on your resume with one of these!

Paul B. Boivin, Jr.
Lincoln, RI

SoftShop Driver

I enjoyed reading Gordon Nichols' article on the Smith-Corona TP-I daisywheel printer [*Sextant* #8, Winter 1984]. As the owner of a TP-I for the past year or so, I agree that it is an excellent printer for home use. I also agree with the comments in the letter from Dave Mann that the Smith-Corona people have been top drawer as far as servicing their machines. My dealings have been with the local service center (Baltimore, Maryland) which did a minor repair on my TP-I, while it was under warranty, and also sold and installed the tractor feed.

By the way, I strongly recommend buying the tractor feed as it is really necessary if you plan on using the printer with fan-fold paper.

The primary reason for my letter is to tell you of my experiences with the "Universal Device Driver" mentioned by Gordon in his article. When I initially tried to use the driver on my H89 with HDOS, it double-spaced each line of text. This was due to the differences in the way the driver and the TP-I handle carriage returns. As noted by Gordon, the TP-I does a line feed and carriage return on the carriage return signal (just like your electric typewriter). However, the driver views the carriage return and line feed as separate signals and thus sends one of each at the end of each line of text.

My requests for help to the driver distributor (SoftShop) were referred to the writer of the program (Charlie Layman, 35 Kendall Road, Sudbury, MA 01776), and we were able to work out this problem and the chain of others that seemed to crop up with each successive fix of the earlier problems. In short, Charlie now has a driver which is ideally suited for use with the TP-I and which takes advantage of some of the printer's special features (such as setting the left hand margin).

Currently I am in the process of modifying the driver to print character combinations for certain characters that the printer currently can not print (such as using "^" for the up arrow). In the past I have had to do this with each program I wrote.

Would I buy a TP-I again? You can bet I would! While Smith-Corona has introduced the TP-II, which is alleged to do away with some of the limitations of the TP-I (like an increase in the number of printable characters, accessible dip switches, and a buffer), the deep discounts currently on the TP-I make it an even better buy.

Richard J. Kiessel
Germantown, MD

[SoftShop, 35 Shadow Oak Drive, Sudbury, MA 01776, 617/443-9693.]

A Computer Dealer's Perspective

Gordon W. Nichols takes a few potshots at computer stores in his recent article on TP-I printers [*Sextant* #8, Winter 1984]. In his search for a dealer, he contends "... if they don't sell it, they don't want to talk about it!" We are a Zenith Data Systems dealer in his locale. Had he called us about the TP-I (and he may have), we would have talked about it! There are several things Mr. Nichols needs to understand about computer stores.

First, no computer store owner can keep up completely with every product on the market, nor can he keep up with all the developments in each of his own product lines. Usually each dealer has several special customers who are able to provide that information, alert the dealer on new products with potential, and on problems with existing products. We certainly do have those customers, and they are rewarded with discounts and special deals.

Even when a new product shows promise, it's not always possible to purchase even an evaluation unit (let alone to begin stocking merchandise). The time to properly evaluate a single new product line for a store probably eliminates many products from the shelf. Of course, I'm speaking about a reputable independent dealer, not the computer supermarkets.

Third, the local computer store has much higher overhead (stocking levels, telephone, store rental, salaries and wages to stay open during business hours, advertising, etc.) than the average fellow selling out of his living room. Since the customer is in close proximity, full service (including full software and hardware configuration) must be included with the sale, or the customer is unhappy. Customers expect no service from the mail order operation. Apparently Mr. Nichols feels the same, since no solutions to his problems were either sought or obtained from The Bottom Line, his supplier.

Indeed, we did have a chance to check out the TP-I at a computer show here in Dallas last year. It was built like a typewriter, not a computer peripheral. It was slow, unidirectional, poorly documented, and the print quality was inferior (uneven lines, imperfect characters). The service network didn't exist (they expected typewriter service centers to handle the job). We didn't even like the rattles the printer emitted during operation. Though we were aching to offer our customers a letter-quality printer for less than $1,000, we couldn't in good conscience offer the TP-I.

Let us hypothesize. Suppose we did handle the TP-I, and that we spent the appropriate time to discover the proper way to set the switches, build the cable, and configure various software packages to fully utilize it. Suppose Mr. Nichols was able to find our small (yet expensive) Yellow Pages ad, and that he took the time to travel from Fort Worth to our store to check it out. I believe that after getting a chance to see the printer in action, noting the cable requirements, and in general taking up the salespersons' time, Mr. Nichols would have rejected the reasonable $895 retail price. He would have gone back home without a printer and picked up the phone and ordered one from New Hampshire.

Our most incredible case was the customer who came to look at a dot-matrix printer ($399, on sale at $299). He let us demonstrate it on Zenith equipment (like his own), spending nearly an hour with him, then left without one. A week later his "buddy" called asking for help on getting the same brand printer going on his pal's machine. When asked where the machine came from, he said another store sold it for $10 less than we did. You can imagine where I suggested he get his configuration information.

This is not to reduce Mr. Nichols to

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the "bad guy." It's human nature to save money. If you can get the information you need without making a retail purchase, why pay retail? The mail order house didn't know Heathkit even existed, I'll bet. They had no investment in research and development to make the TP-I work on one. If the truth were known, they probably operate the same as most of the other mail order people: no stock, no office, no sales people, just take an order, have it drop shipped (the customer doesn't mind waiting one to three weeks), and make 5% or 8% on the deal. If the device fails, give the irate customer the name of a local service center. No mess, no expense, no further word from the customer.

It's interesting that Mr. Nichols was unhappy that he had to purchase his ribbons by mail from a local store because his schedule didn't allow him to buy during business hours. He didn't mind the wait for his printer! Any good retailer would have offered the ribbons to him as he bought the printer. Why didn't New Hampshire supply them, or at least send him the name of a local supplier? Would a local retailer have been able to get away with that kind of service?

Had Mr. Nichols checked with us, he probably would have left with either a Diablo 620 or a Silver-Reed printer. Sure, we carry both, along with more expensive lines. In the last year we've evaluated several other models, and these are the only two in this price range that work without headaches. We have local service on both. Most office supply stores around here stock ribbons and printwheels, although we stock them ourselves for customer convenience. We have researched the cable requirements for all four of the computer lines we carry. We have determined the most advantageous configurations for the most common software packages (like WordStar, PeachText, Benchmark). When we deliver one of these printers, it has already been hooked up to one of our machines, and operation has been verified. The customer is given a little instruction on use and care of the printer.

While Mr. Nichols has deduced that a computer store is down on a particular brand because it's not one the store carries, I believe he's got cause and effect reversed. The store doesn't carry the line *because* they've found it inferior. Most any computer store can obtain any peripheral from a supplier if the customer wants to special-order it. Make no mistake; the retailer is going to carry the lines he feels the majority of the public will demand, else he's out of business. But he has to choose his product line with an eye to after-sale support requirements. With a local customer, problems cannot be ignored like The Bottom Line and Smith-Corona apparently ignored Mr. Nichols' inquiries. The customer has the ability to add to his dealer's client base, or subtract from it, just by word of mouth. Few mail order houses have that weight on their shoulders.

Why don't we see articles describing the trials and tribulations of the Diablo, Silver-Reed, Star, Toshiba, or Prowriter lines? It's because they work, are properly documented, and have local service centers nationwide. If the TP-I was such a great buy, why was the article necessary at all? Nearly every paragraph describes problems Mr. Nichols had getting the TP-I to work. Wouldn't a faster, quality printer that worked from the moment he plugged it in have been worth a few hundred dollars more? Then he could have written a glowing report about its capabilities and ease of use. It seems to me that 73 column inches (plus headlines and pictures!) were spent (not to mention the time readers spent reading it!) merely to describe how Mr. Nichols tried to make a silk purse out of a sow's ear.

Ken Patrick, Owner
Tex-Matics Micro Systems
Plano, TX

Correction

The ad for CIMS, Inc. in *Sextant* #9 listed two different phone numbers for the company. The correct number is 504/254–0545.

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Windows Opens the Door to Compatibility

Microsoft's extension to its operating system provides incentives to software designers to leave hardware-specific code out of their programs.

Frederick Zimmerman

On November 10, 1983, Microsoft announced Windows, an extension of the Microsoft Disk Operating System (MS-DOS). (The Zenith Disk Operating System, Z-DOS, is based on MS-DOS.) Windows will allow MS-DOS users to display several "well behaved" programs on the screen at once, in separate portions of the screen called "windows." "Well behaved" programs include, first, those programs which are written specifically to run under Windows, and, second, those existing MS-DOS programs which handle *all* their input/output through MS-DOS. Since Windows is so new, there are few programs in the first category, but it is probable that many such programs will be developed in the future.

That's because programs written to run under Windows will run *without modification* on any MS-DOS computer using Windows, and at least 23 companies which manufacture MS-DOS compatible computers have agreed to support Windows. These manufacturers include Honeywell, Texas Instruments, Digital Equipment Corporation, Compaq, Hewlett-Packard, Wang, and Zenith, which is supporting Windows for the Z100 and for Zenith's newest computer, the Z150. (IBM hasn't made any public announcements regarding Windows, but Microsoft will adapt Windows to run on the IBM Personal Computer.) So there will be a very large market for Windows software, which means that many programmers will write programs for Windows. The upshot is that Z100 and Z150 users can now be confident that they will be able to run a high proportion of the software developed in the next few years for MS-DOS compatible computers.

What Windows requires on the Z100 and Z150

Windows will require 192K RAM, two floppy disk drives, a bit-mapped graphics display, version 2.0 of MS-DOS, and a pointing device called a 'mouse'. Note that the standard model Z100 comes with 128K RAM, so Z100 users will have to buy at least 64K of additional RAM. (An upgrade kit is available from Zenith for $165—although that's not the least expensive way to buy nine memory chips.) Also note that at this writing, in early February, Zenith had not yet released Z-DOS 2.0, its version of MS-DOS 2.0. However, Zenith announced in early December that Windows will be available for the Z100, so Z-DOS 2.0 should be forthcoming.

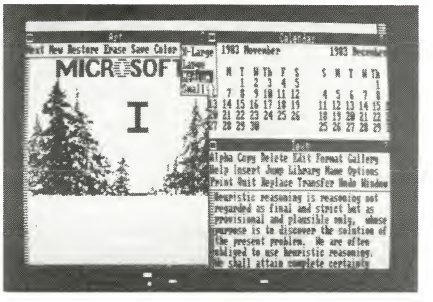
MICROSOF
1983 November
1983 December
Heuristic reasoning is reasoning not regarded as final and strict but as provisional and plausible only, whose purpose is to discover the solution of the present problem. We are often obliged to use heuristic reasoning; we shall attain complete certainty

Photo Courtesy of Microsoft Corporation

Microsoft Windows enables you to display several programs simultaneously.

A mouse is a pointing device, about the size of a pack of cards, which has a tracking ball on its bottom, and one, two, or three buttons on its top. You roll it around on the desktop next to you, and the cursor moves around the screen in response. The advantage is that you can move the cursor to a new location on the screen with just one simple hand movement, rather than the numerous keystrokes which might be required using the arrow keys on a standard computer keyboard. Zenith has announced that it will offer Microsoft's $195 mouse, which will plug into any standard RS-232 port.

Many of the trendiest new products in microcomputing use a mouse. (For example: the software which comes with Apple's Lisa and Macintosh computers; and VisiCorp's VisiON, a software package which performs functions similar to Microsoft Windows.) This is because a mouse makes it easier for new computer users to operate a computer. Moving the cursor by a hand movement is quicker and more natural than keystroke after keystroke on the arrow keys. Moreover, it's easy to use a mouse to select options from a menu, a brief list of possible actions. You roll the mouse around so that the cursor is pointing at the option you want, then simply press a button on the mouse. The intuitive appeal is strong: it is a basic human instinct to point at things we want.

A window manager

Since Windows is an unreleased product, it would be premature to go too deeply into the precise details of the program's operation. Such details may change before the program is actually released. (Which, according to Microsoft, will be in the "late second quarter" of 1984.) However, it is safe to describe Windows' operations in a general way.

One of Windows' major functions is as a "window manager." In this capacity, Windows allows you to manage the presentation of information on the computer's display screen. You can use Windows to display several applications programs simultaneously in different parts of the screen. You can use a program in one window while referring to the information in one or more other windows.

Note, though, that the programs do *not* run concurrently, so only one window can be active at any moment. The information in any other window is frozen until you "open" it.

You give instructions to the program by using a mouse either to point the cursor at an option from a menu, or to point at an "icon", a small drawing representing an action the computer can perform. Judging by the pictures I've seen of Windows (for example, in the December 1983 *Byte* and January 1984 *PC World*), the menu is similar in style and format to the menu used in Microsoft's popular Multiplan spreadsheet. The Multiplan menu is relatively easy to understand and use, and it seems probable that the same is true of Windows.

Similarly, it seems likely that it will be easy to identify and point to the correct icons. There are several icons in each window: for example, the "title" icon shows the name of the program currently active in the window, and the "grow" icon is used to change the size of the window. All you need to do is point to the appropriate icon and press a button,

and the window will change accordingly.

But what do you *do* with Windows? Let's look at an example.

A work session using Windows

First, a caveat: the following hypothetical Windows work session is based upon "sneak preview" information published in *Byte*, December 1983; *PC World*, January 1984; and *InfoWorld*, November 21, 1983. Microsoft demonstrated Windows at the time of the product announcement in November.

You might start by using Windows to create two windows on your screen; call them A and B. You can create more than two windows if you choose; this is just an example.

The program will automatically divide the screen into equal-sized windows. Two windows—one for a spreadsheet, say, and another for a word processor—will fill up half the screen each. Three windows will fill up a third of the screen each, and so forth. But it is easy to change the size of a window using the "grow" icon in the bottom of the window to either expand or shrink it. The other windows will automatically resize themselves to fit on the screen.

(Note that in VisiCorp's VisiON and Apple's Lisa, the other windows would not resize themselves. Growing windows would overlap windows which were in their way, and shrinking windows would leave blank areas on the screen. Microsoft says that its research indicated that users prefer to have "neat" screens.)

Let's assume that you use a spreadsheet program in Window A. You work for a while, using the mouse to move the cursor from one spreadsheet cell to another. When you're finished with one phase of your calculations, you decide that you want to write a memo based on those calculations.

So, by performing a simple sequence of motions with your mouse, you leave window A and go to window B. In window B, you run your word processor and start typing your memo. As you write, you can refer to that portion of the spreadsheet matrix which is still visible in Window A. If you had other windows open, you could look at the information on display there.

If you want to look at a part of the spreadsheet matrix in window A which isn't currently visible, you can easily change the information which is presented in a window. All you need to do is

It is a basic human instinct to point at things we want.

leave window B and move the cursor to the vertical and horizontal "scroll bars" of window A. If you move the cursor to the vertical scroll bar and then move up or down, you will scroll up or down through whatever information the window is presenting (e.g., a text file or a spreadsheet matrix); similarly with horizontal scroll, to the left and right.

How helpful is a window manager?

Window management will save you time, because you won't have to shut down one program to work on another. Admittedly, for most computer users, that's a convenience, not a necessity. Most users could probably get by with just one window at a time. However, multiple windows *are* a nifty gimmick, and Windows will be priced "as an operating system component," i.e. inexpensively. And there are some users for whom it might be very useful to have multiple windows on the screen—accountants, for example, might want to refer to a spreadsheet as they write a report.

Will my current software run under Windows?

Any existing program which was written for MS-DOS 2.0, and which handles input/output *strictly* through MS-DOS, should run properly under Windows.

Unfortunately, the bottom line for Z100 owners is that very few such programs are available at this writing. The fact that a program will run under Z-DOS, Zenith's version of MS-DOS, is not enough to assure you that it strictly follows MS-DOS requirements. It is more likely that the program was written *mostly* for MS-DOS, then customized differently for each MS-DOS compatible computer. Such programs will run as the only window, taking up the whole screen.

You can tell that a program handles input/output strictly through MS-DOS if the software manufacturer makes just one version of the program for *all* MS-DOS computers, *and* you can take that program out of the box and run it under Z-DOS without modification. In practice, only a few MS-DOS programs meet these criteria. (For example, some programming-language compilers.)

If you attempt to run a "misbehaved" application program under Windows, the program will take control of the entire screen. In other words, the misbehaved program will run normally, but Windows will stop working. Windows will operate correctly only with "well behaved" software.

If few of your current programs will run under Windows, why buy it? Because in the future, a great deal of software probably will run under Windows, thanks to what is called a "graphical device interface."

The graphical device interface

The Microsoft Windows graphical device interface (GDI) provides a "logical"—as opposed to "physical"—graphics device through which programmers may control the video display on any MS-DOS compatible computer which has a bit-mapped graphics display. Note that the logical device is defined as a collection of functions; it exists only as software.

A bit-mapped graphics display controls each pixel (dot) on the screen individually, through random-access memory (RAM) dedicated solely to the video display. The need for the GDI arises because many MS-DOS compatible computers have unique schemes for controlling their bit-mapped video screens, or "graphical devices." For example, the IBM PC has a different

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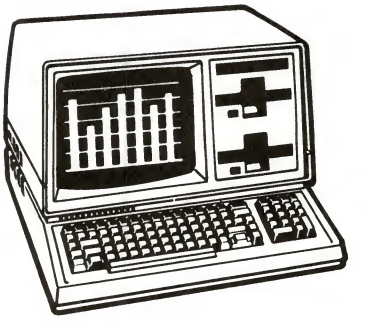

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video control scheme from the Z100. Consequently, MS-DOS programmers have had to adapt their programs to each different computer manufacturer's video display scheme.

This is one of the major reasons why programs written for the IBM Personal Computer will *not* always run on the Z100 or other MS-DOS compatible computers. To succeed in the highly competitive software market, a program must have fast, efficient screen display characteristics. So programmers writing for the IBM PC have taken shortcuts around MS-DOS in order to optimize their programs for the PC's particular video display scheme. Unfortunately, programs so optimized will not work on computers with different (sometimes superior) video display schemes—the Z100, for example.

(For further information on the differences between the IBM PC's video control scheme and the Z100's, see Graham Wideman's article in *Sextant* #9.)

That's where the logical graphics device comes in. It is an artificial intermediary between applications programs designed to draw images on the screen and the various "physical" graphics devices on which those images are to be drawn. The "PC-optimized" programs described in the preceding paragraph can be run on just one physical graphics device, that of the IBM PC. Programs which use the Windows logical device as an intermediary can be run on *any* bit-mapped physical graphics device which runs Windows—including the Z100 and Z150.

The logical graphics device is a collection of the standard functions performed by "physical" bit-mapped graphics devices (such as "draw a circle," "draw a line," "cross-hatch a space"). For each different physical graphics device, there are software routines which translate *from* a generic Windows graphics function *to* the specific code which performs that generic function on that specific physical device.

Those routines are written by each hardware manufacturer in conjunction with Microsoft. Consequently—and this is very important—*applications* programmers don't need to know anything about those software routines, nor about the specific code which performs graphics functions on each physical device.

Applications programmers can develop programs solely in terms of the generic functions for Microsoft's logical graphics device. Windows, with the addition of the appropriate brand-specific software routines, will automatically translate from the generic graphics functions to the specific functions for each computer running Windows. This means that programs written for Windows logical graphics device will run on any computer running Windows.

(Kent Sanders, the Microsoft Windows product manager responsible for liaison with software developers, told me that the technical specifications for the graphics device interface will be available when Windows is released.)

Programmers will no longer need to customize their programs for each computer which has a unique video display scheme. With programmers freed of the burden of adapting their programs for each different video display scheme, programs written for Windows on the IBM PC and other PC-compatibles will become available for the Z100 and Z150 as soon as they are available for *any* computer running Windows.

How much software will be developed for Windows?

As yet, of course, there are very few applications programs available written specifically to run under Windows. However, Microsoft's word processor, Microsoft Word, and the latest versions of their spreadsheet program, Multiplan, will run under Windows.

But as I mentioned at the beginning of this article, the Windows market is large enough that there will probably be many programs developed for Windows.

Indeed, I think it is reasonable to expect that virtually all major software companies writing for the IBM PC and for PC-compatible computers will write their programs to run under Windows. Lotus Development Corporation, Software Arts, Ashton-Tate, and Software Publishing have already indicated that they will support Windows. Moreover, smaller software companies have good reason to prefer to develop programs for Windows rather than for other window management products such as VisiCorp's VisiON. To develop software for VisiON, you must have the equivalent of a VAX minicomputer running the Unix operating system, whereas all you need to develop software for Windows is a computer running MS-DOS.

The most important point for Z100 users and other MS-DOS users to remember is that any software which is developed for Windows will run on any computer using Windows. This should make for an increase in the total number of MS-DOS programs which are *actually* compatible with MS-DOS computers such as the Z100. And that increase will help put an end to one of the most annoying problems in microcomputing today: the proliferation of computers running MS-DOS which cannot run programs written for the IBM PC. By supporting Microsoft Windows, Zenith has assured that Z100 and Z150 users will be able to run most MS-DOS programs developed from now on for the IBM PC and PC-compatibles.

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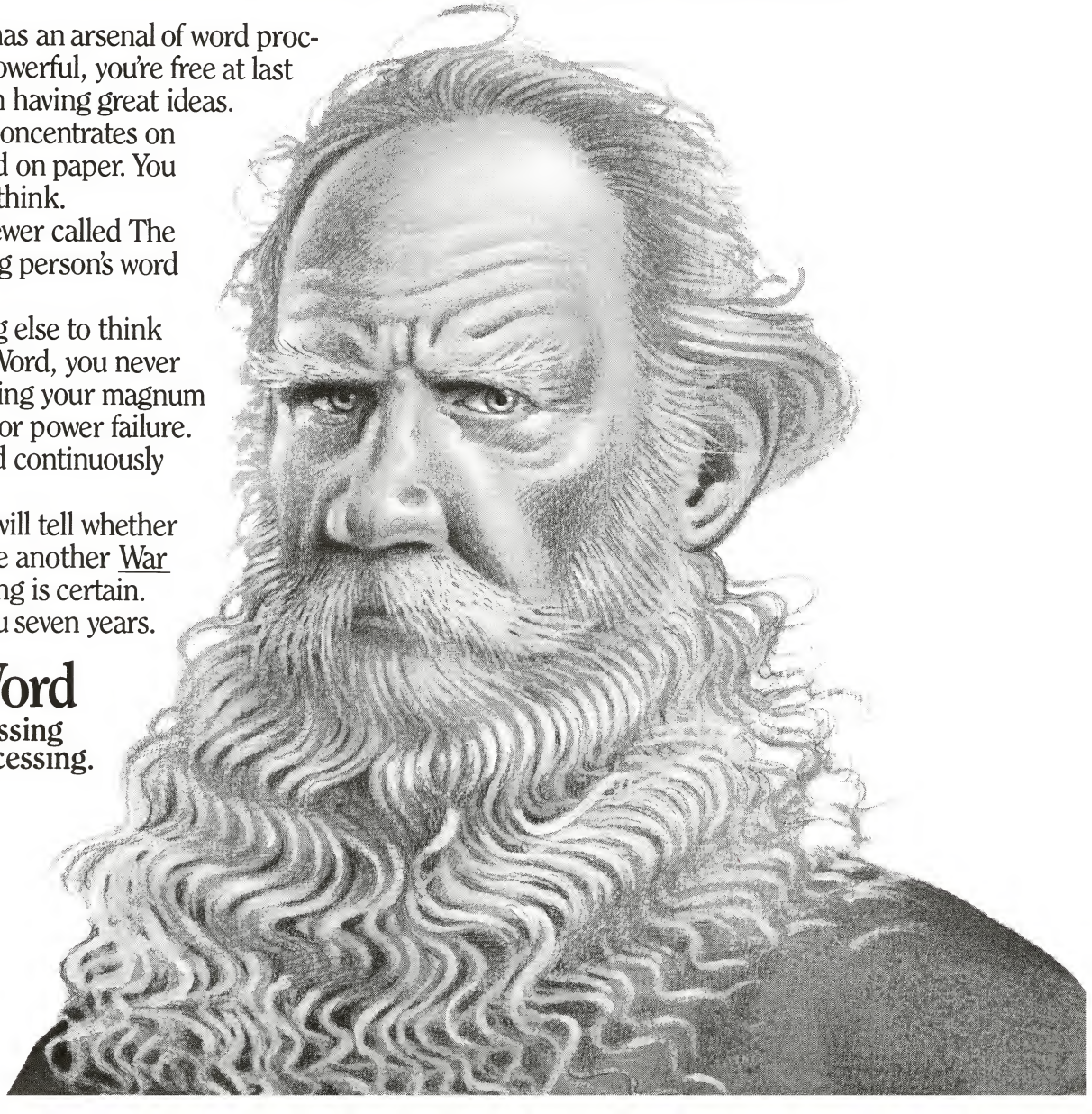

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Color Graphics for Your '8 or '89

High-resolution graphics requires both a graphics board and a good supply of supporting software. Here is a survey of what is available.

Ralph W. Boyd

Since 1981, color graphics has been available for the H8 computer. And for more than two years, owners of H/Z89s could only watch in envy as their H8 counterparts began entering the world of color computing. During 1983, however, two independent companies started selling color graphics boards to the H89 community. Both of these boards are based on the original hardware design of the HA-8-3 graphics board for the H8.

Recently, I have been fortunate enough to use all three of these color boards. I own both an H8 and an H89, each of which now has color graphics capability. In this article, I will take a look at the hardware and the software needed to convert your computer into a color system.

(Needless to say, these color graphics boards will not change your black and white H19/H89 screen into color. In addition to one of these boards, you will need a color television or monitor to convert your system to color. But that choice lies outside the scope of this short survey.)

Of course, both the H8 and the H/Z89 have a basic graphics capability without any additional hardware. The graphics mode—substituting a graphics character for each of the normal characters appearing on the screen—is sufficient for a lot of purposes. The squiggly little aliens or spaceships in an arcade-style game, for instance, are handled quite adequately. Simple bar graphs can similarly be handled for business applications. (One popular graphics editor that stays within the limits of the Heath/Zenith character set is Ed-A-Sketch. It's reviewed in *Sextant* #9, March-April, 1984.)

However, for more sophisticated graphics, we will need the increased resolution that only additional hardware can provide. For instance, businesses wanting to display complex statistical data would feel the need for better graphics. Personally, I got interested in this subject because I wanted better graphics for game programs I was writing. (I mention two of them towards the end of this article.) As a software vendor for Heath/Zenith computers, I have gained a lot of experience in the color graphics capabilities of the H8 and H89.

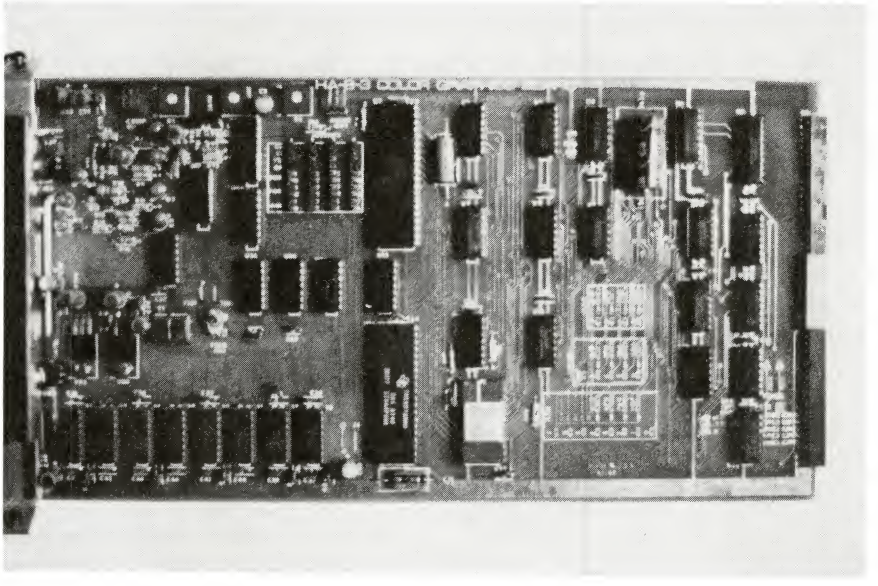

Photo by Ralph W. Boyd

The HA-8-3 color graphics board, designed by New Orleans General Data Services. This board for the H8 set the standard for all later color boards for the H8 and H/Z89.

Whatever your background and needs, you, too, may have longed to have color on your computer. If so, then let me show you just how easy it is to turn your system into a super color graphics computer.

The HA-8-3

The HA-8-3 color board for the H8 was designed by New Orleans General Data Services (NOGDS). The board uses the Texas Instruments TMS 9918A color graphics processor. Also on the board are: 16 kilobytes of video random-access memory (VRAM); an AY-3-8910 programmable sound generator; an eight-channel analog/digital (A/D) converter; and a chip socket for the optional AM9511A arithmetic-processor chip. The board comes fully assembled and tested. Packed with the hardware is a large manual and a demonstration disk.

Most of the manual was apparently copied from the technical data supplied by the chip manufacturers. Each section gives detailed descriptions of the internal architecture of the chips and how they must be programmed. NOGDS includes a well written section on the installation procedure. Additional sections describe the theory of operation and how to use the supplied software to write your own programs to access each of the devices on the board.

A thorough understanding of the functions in each chip is absolutely necessary before attempting to write your first program. Two large schematics are also included with the product. The only software supplied with the board is source code written in assembly language for the H8's 8080 central processor unit (CPU).

(If you are not familiar with assembly-language programming, do not despair. Later, I will describe some high-level language packages to support the color graphics boards, along with an editor that requires no programming experience at all.)

The color and sound output of the HA-8-3 is standard NTSC composite video—the standard for all television receivers sold in the United States. Composite video, of course, will drive a video monitor as is. But if you wish to drive your television through the antenna connector, you will also need a radio-frequency (RF) modulator.

If you already own a video tape recorder, you can connect the HA-8-3 to

the external video inputs on the recorder and send the color video signal to your TV via the recorder's RF output. Another choice is either to purchase one of the RF modulators sold for other systems (such as an Apple computer) or to build a modulator kit such as the one sold by Radio Shack.

When I first installed the HA-8-3 color board into my H8, I built a Radio Shack RF modulator. I was not satisfied with the picture quality, however. Due to the large amount of radio-frequency interference (RFI) coming from my H8, the picture displayed interference lines beating slowly up the screen. Also, the strong output signal from the modulator caused some horizontal pulling. I decided that the best solution was to purchase the GDZ-1320 color monitor sold by Heathkit. The picture I now have has brilliant color with sharper detail and no noise pickup from my H8.

The sound chip used by NOGDS is the General Instruments AY-3-8910. This is a three-voice programmable sound generator with an additional noise channel. The chip contains two general-purpose input/output (I/O) ports, a mixer section for combining the tone and noise channels, and an envelope generator to control the volume. The envelope generator can be programmed for single shot attack/decay or continuous cycles. Once the chip is programmed, the sound effect will be produced without any further intervention by your application program. The AY-3-8910 is capable of producing many types of complex sounds. (For more on this chip, see "Build a Sound/Clock Board for Your '89" by Ray Albrektson, in *Sextant* #9, March-April 1984.) The demonstration disk comes with the sound effects of an explosion, a wolf whistle, and a race car shifting gears.

The board also contains an AD7501 eight-channel analog-to-digital converter. This chip is normally used for the joystick inputs but could also be used for functions where analog inputs are needed by the computer. For example, you could read the voltage across a thermistor to determine the room temperature.

The first programs people wrote for the HA-8-3 used the AD7501 to provide inputs for analog joysticks. They were wired as suggested in the HA-8-3 manual and this configuration has since become the de facto standard for all H8 programs using analog joysticks. The first program I purchased which used joysticks was Meteoroids by Omnitrend. Since then, several offerings from the Heath Users' Group (HUG) have adhered to this standard.

I originally built my own HA-8-3 board for use with a Jameco Electronics joystick sold in a local Heathkit Electronic Center. You can now order an assembled joystick from Weitzman Associates of Pembroke Pines, Florida.

NOGDS's demonstration disk contains several programs for testing the color, sound, and joystick sections. Two useful programs will display a set of NTSC color bars on your monitor so you can properly adjust your color and tint controls. The disk also contains some very complete 8080 source-code routines which you can use in your own assembly programs. There are routines for setting the chip memory registers, passing data to and from the video RAM, and reading the joystick ports. And there are arithmetic routines for the optional AM9511A math chip.

The HA-89-3

NOGDS now sells the HA-89-3 color graphics board for the H89. This board comes fully assembled and tested like its predecessor, the HA-8-3. It, too, uses the TMS-9918A and AY-3-8910, but that is where the similarity ends.

The HA-89-3 contains an ADC0809 eight-channel A/D converter, an 8253 programmable counter/timer, and an 8259 programmable interrupt controller. As options, you can add the Votrax SC-01 Phoneme Speech Synthesizer, the AM9511A arithmetic-processor unit, and the AD7542 digital-to-analog converter (DAC). For its price, this board contains a lot of computing power. The only drawback is that this board is not completely port-compatible with the original HA-8-3.

In the H8, all the CPU's address lines are available on each of the ten 50-pin bus connectors. It is, therefore, quite easy to fully decode any of the 256 port addresses from 000 to 377 octal. The H89, however, does not have the ability for complete port addressing on its 25-pin connectors. Heath chose to use an I/O-map-decoder read only memory (ROM). This ROM, U505, addresses the right-hand-side connectors P504, P505, and P506. In most normal configurations, P506 is used for the hard-sectored disk controller board and P505 for the three-port serial I/O board. NOGDS recommends that the HA-89-3 be installed in either P504 or P505. If you are not using the tape cassette board or a soft-sectored disk controller board, then you will probably have P504 available. You will want to use it for the graphics board.

Since the HA-8-3 comes jumper configured as port 320 octal, you will therefore have to remove the middle 8250 UART on your HA-88-3 serial card.

If you wish, you may move the board's jumper in order to decode the card for address 330 or 340, but you will have to remove the proper 8250. For these addresses, you will also have to modify

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the NOGDS support software. NOGDS describes this process in section 6.3 of their manual.

I don't recommend using these non-standard addresses because you may find that application software you purchase in the future will not be port compatible. If you are using both a soft-sectored and a hard-sectored controller card, you will have to remove your HA-88-3 serial card and install the HA-89-3 graphics card each time you need to use it. This, too, is not recommended since it will increase the likelihood that you will misalign the card edge connector pins and damage your H89. (Although I have not tried it, you might be able to use a port expander board to get more slots for installing all the boards at once.)

The HA-8-3 graphics board for the H8 uses the eight de facto standard port addresses beginning at 270 octal. Since the HA-89-3 cannot address these ports, you may find that some of the software written for the H8 will not run on the H89. Most software vendors either have modified their H8 programs to run on the H89 or supply the source code so that you may reassemble it.

Simply changing the port address in some of the software may not be enough to make it compatible. The HA-89-3 has eight devices on the card. Each device can be accessed by first writing a select code to an on-board register at port 320. All further I/O through port 324 will then refer to the selected device. If the source code you are modifying was not written to handle these extra byte transfers, you will have to make the proper changes in the program.

As with the HA-8-3, the output from the HA-89-3 is NTSC composite video. There are separate outputs for the sound and speech chips so that you may send them to separate amplifiers. You should not try to drive a speaker directly with these outputs.

Once you've heard your computers talk, it will be difficult to keep them quiet.

The best choice is to use the mixer output so that both sources will be combined with the video signal and sent to your TV or monitor. Again, if you are using a TV instead of a monitor, you will need to get an RF modulator. All the cabling for making these connections is supplied with the board. You need only install the connector which your external hardware requires on the end of the cable. Complete instructions are given in the manual.

The color and sound chips work in the same manner as described for the HA-8-3.

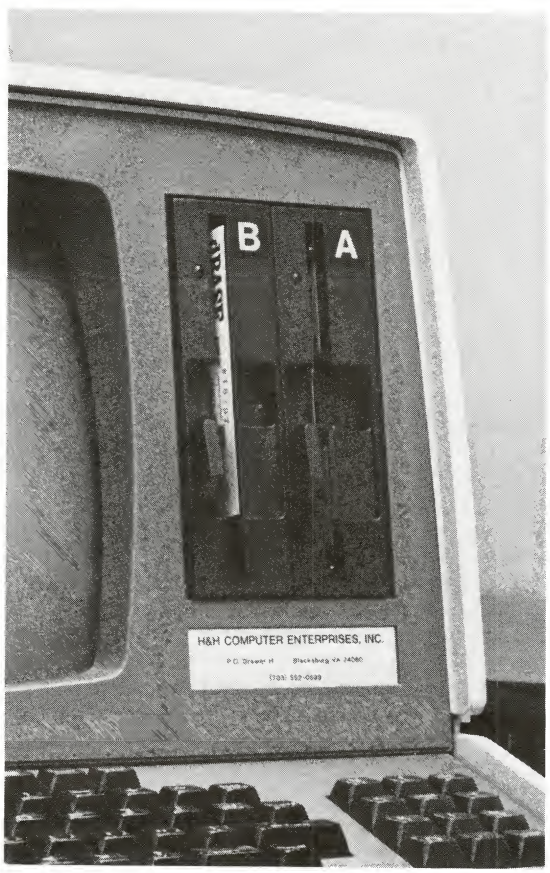
The other devices on the card will bring joy to all you hackers out there. The 8259 can be used for intelligent interrupt handlers. The 8253 will give you real-time clock capabilities. The DAC interface could be used for driving an analog XY plotter. What can I say about the Votrax speech synthesizer? Once you've heard your computers talk, it will be difficult to keep them quiet.

The supplied software is the same as that distributed with the HA-8-3. The manual is complete and contains all the manufacturers' data sheets on the new chips. Full description of the theory of operation and detailed schematics are also included.

Weitzman Associates also sells H8-compatible joysticks for this board. Or, by following the instructions in the NOGDS manual, you can make your own joysticks, if you desire.

The Entertainer

The Entertainer from Sandia Computer Products (SCP) is an "H8 port compatible" color graphics board for the H89. It contains the same TMS-9918A color chip and the AY-3-8910 sound generator. Unlike the HA-89-3, this board is fully compatible with software written for the HA-8-3—except for the joystick interface. However, since this board does not contain any A/D converter, you cannot use an analog-type joystick. It is possible to use the general



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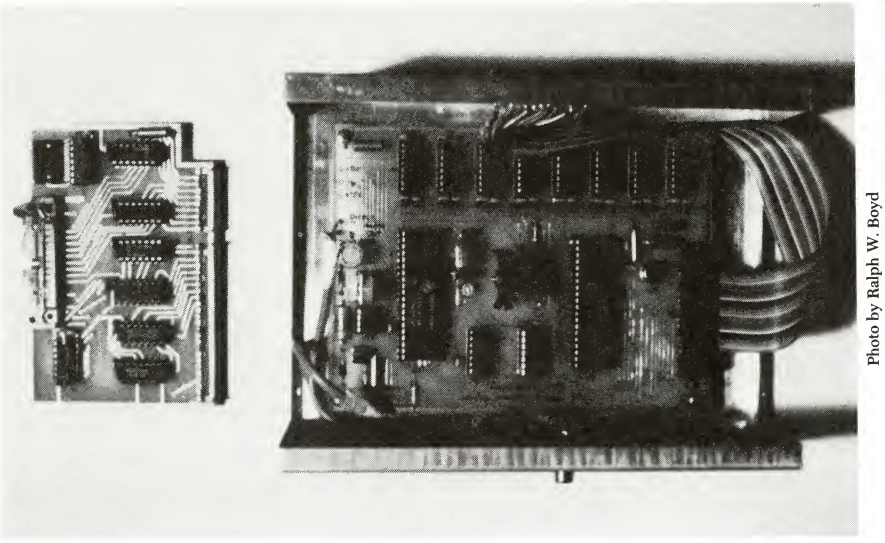

Photo by Ralph W. Boyd

The Entertainer color graphics board from Sandia Computer Products. The small board on the left is the interface card for the larger Entertainer board on the right. The graphics board itself is to be mounted in a case external to the H/Z89.

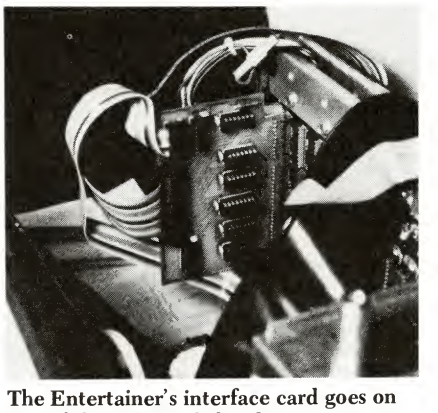

Photo by Ralph W. Boyd

The Entertainer's interface card goes on one of the H/Z89's left-side connectors.

purpose I/O ports in the programmable sound generator (the AY-3-8910) for switch-type joysticks. At the time of this writing, I am not aware of any joysticks which support this option.

The Entertainer comes either fully assembled or in kit form, complete with two circuit boards, all cables, five manuals, and a demonstration disk.

I purchased one of these systems for my H89 as an assembled board, so I cannot comment too much on the kit version. From the construction manual, I can say that it appears to be well written in a step-by-step method similar to most Heathkit manuals. The pictorials are a bit simple, though, and there are no parts pictorials. The novice kit builder may have some difficulty in parts identification, but the average kit builder should have no trouble at all. The best feature about this manual is the Heath-style troubleshooting guide. Of course, a complete schematic is given in the construction manual; but there is no description of the theory of operation.

Like the manufacturers of the other boards, SCP has supplied the technical manuals on the TMS-9918A and the AY-3-8910. Best of all, they have included two other manuals on how to use and program the graphics/sound board.

The Color Graphics Primer summarizes the information given in the technical manuals, and the Programming Manual describes how to program the board using BASIC. SCP gives some interesting tips on how to increase execution speed by using the various memory registers of both the color chip and the sound-generator chip. For most applications, though, you will find that BASIC is too slow.

Installation is very easy. Unlike the HA-89-3, you can connect the I/O card into any slot on the left side of the H89. So you don't have to sacrifice any disk controller cards or serial I/O ports. SCP chose to pick up the additional hardware lines for full address decoding by removing U553 from the H89 CPU card and installing it in a socket on the color-graphics I/O card. A 14-pin ribbon cable with DIP connectors on both ends is then used to connect socket U553 to the I/O card. A second ribbon cable is then connected to this card and routed out through the rear of the H89. The far end of this cable attaches to the external graphics/sound board. You will have to install this board into a chassis case of your own, since SCP does not supply one with the product.

Like the other boards, the output is composite video and will require either a video monitor or an RF modulator for your TV. The ribbon cable from the I/O card to the rear of the H89 is actually in two parts. This cable is terminated in a 26-pin DB-25 female plug which SCP recommends should replace port connector 320 on the rear panel. I chose to remove the rear panel and cut a hole in it to accept this new plug. The cable from the graphics board then connects into this plug via a DB-25 male connector.

High-level programming languages

Earlier, I mentioned that you could use BASIC for programming the color boards, but you would find that it is too slow. Of course, you could use assembly language, but that may be more involved than you want to get. A better alternative is to use one of the language packages described in the following paragraphs.

I have found Lucidata Pascal from Polybytes to be the best high-level language which fully supports all the features on these boards. This language comes with a well written manual and in versions for either the Heath Disk Operating System (HDOS) or CP/M. There are special features in this language which will let even the beginner easily program the color board. For the more advanced user, Lucidata Pascal has routines for direct access to the chip registers.

The code is compiled into a pseudo code (p-code). Use of an "intermediate" code like this is intended to increase the software's portability between machines. It's sort of a "half-way house" between the program you would write yourself and the final compiled version that would actually run on your machine. So people writing in Pascal can produce a p-code version that can then be used by a number of machines. Users only need the software to translate the p-code into a form acceptable by their machine. Polybytes also sells such a program which will translate the p-code into 8080/Z80 source code. This source code can then be assembled by Microsoft's M80 into machine code for additional speed.

One objection to the use of p-code has frequently been that you must sacrifice some speed in order to gain the portability. Personally, I have not found this to be a problem with Polybytes Lucidata Pascal. I do all my programming in p-code and have found it to be very fast indeed. In fact, I had to insert delay loops to slow it down for an arcade game I wrote. It ran so fast, players could not move the joystick fast enough to win the game.

For those of you who like Tiny Pascal, it, too, can be used. Its lower price may be more to your liking. Fred Pospeschil of Bellevue, Nebraska, sells Graph-Pac-1, device-driver support routines for Tiny Pascal. Included is an enhanced version of the Tiny Pascal compiler with 123 sectors of documentation on the disk.

This package is a full set of graphic support libraries (GSLs). Some of the standard routines in this package are similar to those in Lucidata Pascal. This was done so that conversion between both Pascals could be easily performed.

Graph-Pac-1 also supports Digital Research's Pascal MT+ under HDOS and CP/M. For this language, the GSLs are searchable libraries of relocatable load modules, so they can be combined

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as appropriate for your application. The graphics routines will be combined with the user's program during the LINK operation. For an additional price, you can get the source code for the GSLs in MACRO-80 assembly language.

There is, however, one significant difference between Mr. Pospeschil's GSLs and most other language packages. The color-graphics chip uses a coordinate system to define the location of pixels (i.e., dots) on the video screen where the upper left-hand corner is referenced as position (0,0). Accordingly, most of the language packages have built-in functions—such as MOVE(X,Y), PLOT(X,Y), etc.—which address the video RAM from the upper left-hand corner of the screen. In Mr. Pospeschil's routines, however, the (0,0) reference position is adjusted to the *lower* left-hand corner.

Although this might be the more logical position for the coordinate-system reference point, it is not the standard. So, if you are converting a program written in some other language, you may have to modify the code to adjust to the new reference. This also affects the operation of any joysticks since the up-down positions will be reversed. You will, therefore, have to have a joystick wired in reverse up-down order to be able to run software written for the standard system. In his documentation, Mr. Pospeschil describes both wiring methods for the Jameco JVC-40 joystick.

For you FORTRAN fans, FMS Associates sells a library support package for Microsoft's FORTRAN-80 under CP/M and HDOS. Their package will work on the HA-8-3, HA-89-3, and the Entertainer. There are individual packages to support HDOS or CP/M for each of the color boards. Each package is a searchable library running under Microsoft FORTRAN-80 and LINK-80. So only those routines used by a program will then be LINKed into the final program. Since all four packages are functionally the same, it is easy to re-LINK a user's program onto a different color board and/or operating system.

You'll certainly want HUG's Color Raiders.

Full support for color, sound, and the joystick ports is provided in the software; and a 100-page printed user's manual is supplied with each package. The complete source code for each package is sold separately.

One special feature of this software package is that it contains routines to play songs written in the HUG COMPOSE program. The four subroutines set up an interrupt-driven music playing system. Once this system is turned on, the main program is then free to perform other functions while the music plays in the background.

Another FORTRAN graphics package is sold by Microtran. Micro-Core is a set of FORTRAN subroutines which can be called by your program. It implements the essential features of the proposed American National Standards Institute (ANSI) standard for graphics systems. The software uses a device-driver program, also sold by Microtran, to interface to the HA-8-3 or HA-89-3 graphics boards.

Both documentation and source code are supplied on a disk with the Micro-Core program. The software is currently supplied only in HDOS format. However, Rick Lutowski of Microtran has informed me that the system is not functionally dependent upon HDOS. So conversion to CP/M should be a simple matter of disk conversion.

Micro-Core software does not support the sound, speech, analog-to-digital, digital-to-analog, or math-chip devices on the color boards. The system was designed to be compatible with the proposed ANSI standard which does not recognize such non-graphic functions. Microtran does have another package which will support the AM9511 math chip. To access the other devices, however, you will have to write your own I/O routines.

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For the non-programmer

Colorworks sells three programs which are particularly suited for business applications. SKETCH (CP/M or HDOS) is a color screen graphics editor. This program will let you change the color of areas of the screen, draw and erase lines, and define and move sprites (animated objects). Objects can be rotated, translated, scaled, or duplicated anywhere on the screen. When your graphics design is complete, it can be saved on disk.

CTYPE (under HDOS) is similar to SKETCH in that you can use it to edit text on the color screen. You can also draw lines and circles and color areas on the display. With this program, you can create graphs and bar or pie charts, and label them.

SLIDES (under HDOS) is a special program which acts much like a slide projector to let you display the color pictures you created with SKETCH or CTYPE. Through a software switch in the command file, you can have color slides projected on the color monitor in a continuous loop. If you intend to use your color board for business or scientific purposes, then these programs will be well worth their nominal price.

A three-dimensional graphics package is also sold by Colorworks. THREED (under HDOS) is a program like SKETCH; and it lets you define and locate three-dimensional objects in an x,y,z coordinate system. Once you have positioned the objects, you change the perspective by telling the program where you are (eye point) and what you are looking at (center of interest). You can even clip the scene against a viewing window. You can then load the saved scene into the VRAM so your own program will be able to move your sprites.

THREED does take a long time to draw the images so its main use will probably be for developing scenes for background patterns in 3-D games.

Games, etc.

So far, I have operated on the assumption that Heath/Zenith users will be concerned with color graphics from the perspective of software developers or business users aiming to increase the power of their programs or computers. But most of us take time to relax, too.

Games and educational programs can be a lot more enjoyable and effective with more sophisticated graphics. I've had the opportunity to look at some (and write a couple) that make use of the color graphics boards described above. Of course, as more users purchase these boards, more software will be written.

So what follows should not be regarded as exhaustive. Right now, there are not too many programs on the market. But although I tried to get hold of any programs that I knew required the use of a graphics board, there are more out there. This selection, then, is only a start. I hope, though, that reading about and using programs like these may spur some of *you* to get into the field.

For whatever reason you want games, though, if you're a member of HUG, then you'll certainly want HUG's Color Raiders (for HDOS, part no. 885-1114).

This space action game has the best color and sound effects of any game for the color boards. You must maneuver your space craft to fire at an enemy ship on your target screen. You use your keyboard to change your speed and direction. Once the target is lined up in your gunsight, you fire your laser cannons by hitting your spacebar. If you hit the enemy ship it will break up into pieces and drift off into space. As you continue to fly into the three-dimensional space, you will encounter more enemy ships. The game will continue until your shields are finally destroyed by the returning fire from the enemy ships.

Hoyle & Hoyle Software sells Rapid Recall and Brick Break for the HA-8-3, HA-89-3, and Entertainer boards. Both programs run under HDOS and are supplied with complete source code on the disk.

Brick Break is the standard home video game of Breakout. You use your keyboard to move a paddle to hit a bouncing ball. The ball will move to the top of the screen and knock out colored bricks from a wall near the top of your screen. As you hit the ball, it may change its angle and speed. You will then have to quickly reposition your paddle to catch the next rebound from the wall. You win by accumulating points. Since this game does not use joysticks, you will find it a bit difficult to move the paddle by using just the keyboard. Even so, I found the game to be a lot of fun and very challenging in the higher skill levels.

Not so with Rapid Recall. This is the simple game of Recall where you compete with the computer to remember a sequence of colors and sounds. The computer will start a color/sound sequence and wait for you to respond with the same sequence by striking the proper keys on the keypad. I found the graphics to be a bit too simple and uninteresting. This may be a good game for young children, but anyone over the age of five will soon become bored.

And as I mentioned above, I'm in this field, too. I sell HDOS & CP/M color programs for the HA-8-3, HA-89-3 and The Entertainer. BLAST is a flying saucer game in which you must destroy all the cities on an enemy planet. You use your joystick to position your saucer above each of three cities on each screen. Hit your fire button and your laser beam will incinerate the enemy city in an atomic

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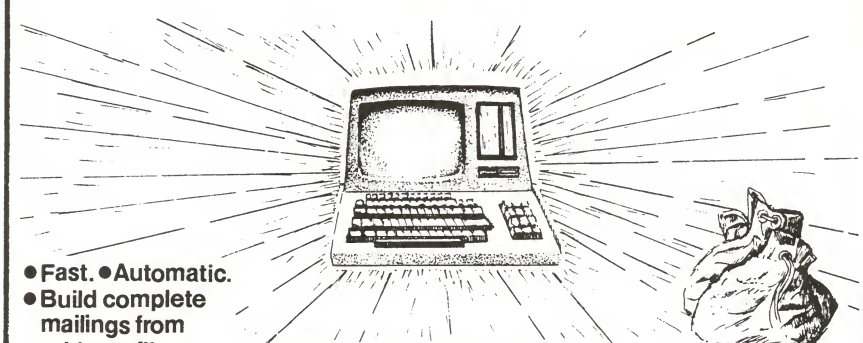

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blast. Each city will try to defend itself by firing photon torpedoes or its own maser weapon. You have to move quickly to dodge the torpedoes and destroy the cities before they can charge up the masers.

Hurricane Tracking is a color data base program which lets you track new and old Atlantic hurricanes. This program contains historical data and will display up to two hurricanes on a detailed map of the northern half of the Western Hemisphere. As the hurricanes move, they will change shape from tropical depressions to storms to rotating hurricanes. This program uses the high-resolution Graphics-II mode of the color chip to produce a map with an accuracy of ¼ degree in latitude and longitude. Other program functions let you enter data for new hurricanes, change disks and system defaults, make corrections, and print out data for a selected hurricane.

Final comments

In this article, I have described three color boards for Heath/Zenith computers. We have seen that the HA-8-3, the first and only color board for the H8, has become the standard by which all other boards should be measured. Of the two boards for the H89, the Entertainer adheres the most to this standard but lacks the joystick ports. The HA-89-3, on the other hand, is more versatile than the Entertainer but is not port-compatible with software for the other two color boards.

For color software, BASIC could be used but would likely be too slow for most applications. A better choice would be to use a color graphics support package for Pascal or FORTRAN. Each of these packages will make it easier for you to develop your own color programs without resorting to 8080 machine code.

I hope this article has answered some of the uncertainties of how to convert your computer into a color system. Whether your need is for games, business, or scientific applications, color graphics will open a whole new world to your programming experience.

Ordering Information

Graphics boards:

The HA-89-3 ($299) and HA-8-3 ($299) color-graphics boards
New Orleans General Data Services
7230 Chadbourne Drive
New Orleans, LA 70126
504/241–9495

The Entertainer color-graphics board ($310 kit, $365 assembled)
Sandia Computer Products
7105 Merle N.E.
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Joysticks:

Joysticks for the HA-8-3 and HA-89-3 color boards ($11.45)
Weitzman Associates
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Joystick components
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Belmont, CA 94002
415/592-8097

Language support:

Lucidata Pascal (CP/M or HDOS $55 each, or $100 for both); p-Code Translator (CP/M or HDOS $25); and Graphics/Sound/Math Support Package (CP/M or HDOS $25)
Polybytes
325 19th Street S.E
Cedar Rapids, IA 52403
319/366-3077

Graph-Pac-I color-graphics support for Tiny Pascal (CP/M or HDOS $39); Graph-Pac-II for Pascal MT+, C/80, MACRO-80, FORTRAN, COBOL, and MBASIC (CP/M or HDOS $39 for first language, $10 each additional language)
Fred Pospeschil
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Color-graphics libraries for CP/M or HDOS FORTRAN-80 ($45)
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Micro-Core Device Drivers for FORTRAN (HDOS $38) and Micro-Core FORTRAN-callable graphics package (HDOS $61)
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Graphics editors:

SKETCH, CTYPE (CP/M or HDOS $35 each); SLIDES (HDOS $30); and THREED (HDOS $50)
Colorworks
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Games, etc.:

Color Raiders (for HUG members), HUG part no. 885-1114 (HDOS $20)
Heath Users' Group
Hilltop Road
St. Joseph, MI 49085
616/982-3463

Rapid Recall and Brick Break (HDOS $16.95 each)
Hoyle & Hoyle Software
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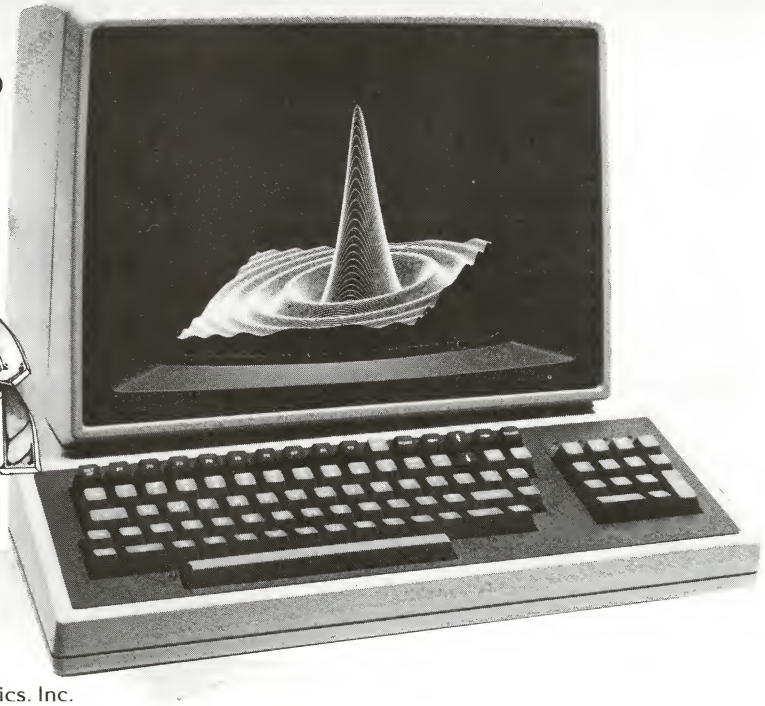

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Forming a Local HUG

It doesn't have to be a "one-man show."

Herbert A. Friedman

When you buy your first Heath/Zenith computer, you receive information about the national Heath Users' Group. Finding out about local HUGs may not be so easy.

After I joined the national HUG, and received a couple of issues of *REMark*, I could see there were a lot of people all over the country who were interested in computing; but I was overwhelmed by the amount of knowledge they displayed in their articles. Much of the material I read was beyond my comprehension. I knew that if I worked hard at it, someday I might understand the material; so I saved the *REMark* issues, and tried as best as I could to learn as much as I could.

The people at the local Heathkit Electronic Center were friendly and helpful, but certainly unable to answer questions in depth. I inquired whether there was a local users' group. "No," was the reply, "but we might be forming one next year."

"How many others," I thought, "like myself, have many unanswered questions and a desire to discuss them at length with others with similar interests?" Getting started with a brand new computer is an exciting experience, but often a frustrating one, especially when things don't work the way the manual says they should. You can't keep calling the Heathkit store every time you run into a little problem. And the phone bills would get completely out of hand if you had to rely on Heath's technical assistance lines at the the company headquarters in Benton Harbor-St. Joseph, Michigan.

So there is a definite need for a local users' group that can provide a forum for the discussion of common problems and their solutions. That aspect alone is a good reason to have a local users' group, and there are many more.

A definite need existed. But how does one go about forming a users' group? Here is how one local group was formed. Perhaps this experience might be helpful to others contemplating starting their own local users' group.

The first steps

Sizing up the local area is a good way to start. Whether the area is urban, suburban, or rural will determine the size of the group as well as the location of the meetings. Smaller rural groups could meet in members' homes, but this would be impractical for the larger groups. Our group is located in Southern California, a sprawling territory with millions of people enjoying the climate, the mountains, the desert, the ocean, and especially the smog. Our particular area, Pomona, is located about 40 miles to the east of downtown Los Angeles, and is suburban in character. Looking around the region, there is a Heathkit Electronic Center in Pomona, as well as one to the west in downtown Los Angeles, to the northwest in Woodland Hills, and to the south in Anaheim. Each one of these now has a local HUG.

You can't keep calling the Heathkit store every time you run into a little problem.

The need for a local HUG in Pomona clearly existed and the place for it to meet would be the Pomona Heathkit Electronic Center. I discussed this with the local store manager and he said they were thinking of starting one in a few months. Several months later, he said the same thing! It did not appear that he was really interested. I found out that a year or so before, a small local HUG had begun, only to disintegrate a few months later. "Why?" I inquired. "Well, it was a 'one-man show,' and the 'one-man' left town and it fell apart." I could not blame him for being a bit soured by this experience.

The next step was to speak to the area manager. I called him and he was enthusiastic about the idea. He agreed to help get things started. I met with him personally and we selected a target date for the first meeting.

At this point, we had a commitment to go ahead. We were officially encouraged by the local management, and implicitly by the powers-that-be in Benton Harbor.

There are advantages to using the Heathkit Electronic Center as a meeting place. Its location is well known to the members. It avoids the need to find another meeting place, which might possibly involve a rental fee or other recurrent expenses. The computers are right there for use by speakers. Facilities for copying disks are available. Our local Heathkit store has supported our group by providing a monthly meeting place, free of charge. It has also assisted with office supplies, postage, and support for the newsletter.

As this article continues, I hope you will see the importance of a good relationship with the local store. But the relationship should not be a one-way street. It entails responsibilities on the part of the local HUG. (For instance, it was agreed that invited speakers, while in the store, would not directly sell to the members those Heath/Zenith products that the Heathkit Electronic Center had for sale.)

The first meetings

We had no organization as yet, no officers, no members. All we had was a commitment. The area manager arranged for a mailing to a list of recent computer purchasers. It was a simple announcement, stating that a users' group would be forming and that prizes would be given at a drawing to be held on the night of the meeting. You had to be present to win. It was pretty unimpressive, as letters go, but it was a start. What would the response be?

A simple poster was worked up and placed on the front door of the Heathkit store about two weeks before the first meeting.

As the first meeting approached, I wondered what sort of response we would get. It was a warm April evening. The store had about 60 chairs, set up in classroom fashion. On each chair was placed a survey form (generated on an H25 printer). It included a questionnaire and a membership application. As the meeting time approached, the seats gradually filled up. Soon, all seats were filled and people were standing in the rear.

The meeting was opened by the area manager. He talked about some Heathkit products, answered questions, and explained that the store was willing to support a users' group. He introduced a member of a nearby local HUG, who spoke about the advantages of a local group. Most of those present expressed an interest in joining the group and handed in their applications. To maintain interest, several pieces of software were given away as door prizes. One lucky person won SuperCalc!

Those volunteering to hold an office were asked to step forward, and five people did so. These people agreed to meet and plan the next meeting. They were given titles, such as president, vice-president, secretary, and treasurer.

The individual from the existing HUG agreed to help us get started.

About two weeks prior to the next meeting, some of the officers got together for their first meeting. We recognized the importance of planning ahead. We defined the general format of our meetings and we developed a general philosophy. The philosophy: our prime reason for existence was to allow an interchange of ideas, problems, and solutions among our members; the more experienced and knowledgeable members would help out the newer and less experienced ones. We established a simple policy regarding software: no proprietary software would be distributed or copied.

The structure of the meetings was simple: a short business meeting would be followed by a guest speaker or special presentation of about 30 to 40 minutes. The rest of the meeting would be for general discussion, or open forum. Here, individual members could present their problems, and perhaps other members could come up with solutions. This format has proven extremely successful. It has recently changed slightly, in that following the open forum, the group breaks up into smaller Special Interest Groups for very detailed discussions.

Keeping in touch

A key to success has been careful attention to detail. Such things as arranging in advance for guest speakers, setting up chairs, mailing out meeting notices, or preparing agendas for meetings all involve extra time and effort. But it is just such preparation that seems to ensure positive results. Announcing an upcoming meeting at the proper time is important. It should be done about one to two weeks in advance. We used posters for this, which were run off on an H25. A poster was placed on the door of the Heathkit store, and others were mailed out. Maintaining a current mailing list is essential. One list originally contained about 200 names of recent purchasers of Heath computer equipment. The other list was our local HUG membership list. A large part of our membership came from the first list.

Finding interesting speakers was a challenge. We were fortunate to have several hardware and software vendors in our area. Among our speakers were Walt Bilofsky of The Software Toolworks, Marc Brooks of C.D.R. Systems, Bob Koepke and Ken Smith of Kres Engineering, and a representative of Ashton-Tate. As our membership grew, we found that some members could give interesting presentations. We made use of their talents. If members attended relevant computer conferences, they could give reports. Some members with special expertise have given extremely interesting presentations. We have had talks on modems, disk drives, and "Troubleshooting the H89." One talk was about the National HUG Conference. All have been enthusiastically received.

After the first meeting, it was decided that a monthly newsletter would be desirable. A one-page sheet was made up. This was volume one, number one, and was mailed to the 200 people on the mailing list.

The group supplied the labor and Heath provided the supplies and postage. We found an individual willing to be the editor. The newsletter has turned out to be a significant factor in the group's success. Its length is six to twelve pages and it carries material written by club members, as well as material obtained via newsletter exchange with other groups.

As our group grew, we felt a gathering momentum. We wanted to maintain the initial interest and not let it fade as quickly as it had started. This has become more difficult as time has passed. Good speakers and good material for the newsletter seem to become scarcer as a group gets older. The officers of the group have the responsibility to try to provide things that the membership want, but at the same time initiate new things that may or may not prove successful. One has to be flexible, yet maintain continuity.

To maintain the high level of initial enthusiasm, it seems necessary to have a meeting of the club officers about ten days prior to the regular monthly meeting. Here the short- and long-range plans are formulated, the newsletter is presented for publication, and new ideas are encouraged. This exchange seems to "recharge our batteries," at least until the next meeting. We have, therefore, not experienced a "burnout" problem. Burnout might more likely hit groups that overwork people or have them working in isolation from others.

Dues and by-laws

Dues were established at twelve dollars per year. Operating expenses were small. The main expense was for preparation and mailing of the newsletter, which was partially subsidized by the Heathkit store.

A conscientious treasurer, who maintained accurate financial records, was essential. A set of by-laws was written, in clear English, which set up the structure of the group. The by-laws included the following statement: "Pomona HUG will comply with the copyright laws of the United States with regard to copyrighted software." That policy has not changed.

Saving money

One of the major attractions for new members is the promise of free software. In the beginning, with a smaller membership, we established a disk-exchange

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program. The common disk format was the single-sided 40-track hard-sectored disk used with the H8 and H/Z89 computers. (The H/Z100 series was not yet available.) Each member received four disks—two for use under the Heath Disk Operating System (HDOS) and two for use under CP/M. The disks were exchanged at each monthly meeting.

Most of the software was obtained from the CP/M Users' Group Library. A small amount of public-domain software was available to us for HDOS, but that was soon exhausted. Fortunately, we've only scratched the surface with CP/M software. As the membership grew larger, the mechanics of disk exchange became unwieldy, and our supply of disks ran out. We needed a better method for software distribution. We decided to use a computerized bulletin-board system. Members without modems have continued with disk exchange, but on a smaller scale. Soon a large amount of software was placed on the bulletin-board system.

While setting up the bulletin-board system, the cooperation of the Heathkit store was essential. Not only did they arrange for a dedicated phone line, but they let us have some space on their hard disk.

Our first effort was a fairly primitive system running under MBASIC. It was for message exchange only. Many of the early messages urged us to upgrade to a better system, so we purchased RCP/M, a bulletin-board system that is in common use. This permitted up- and down-loading of lots of software, and provided the members with easy access to the software library. We have a password entry, so the system can be used only by local HUG members. Two members help run the system.

A group discount program was also introduced. Its success has depended on the items being discounted and the depth of the discount. We initially offered group discounts on the three modems that Heath sells. Discounts were substantial, but not as deep as those advertised by discount houses in computer magazines. As a result, there was no interest and the program fell through.

On the other hand, when the store manager agreed to a group purchase of H/Z100 computers and accessories, there was much interest. It seemed that no one could get a better price, anywhere, on the kits. Inquiries came from all over. One had to be a local HUG member to participate in the program, so our membership increased. The resulting gross sales of nearly $54,000 was welcomed by the local store.

Conclusion

That is how our local HUG evolved. In our case, there seemed to be three essential ingredients. First, there was a need for such a group among many local Heath users. Second, there was a small group of enthusiastic, dedicated volunteers willing to do some work.

And finally, there was the substantial support given by the local Heathkit Electronic Center. Without it, supporting a newsletter or a bulletin board, for instance, would probably mean a higher dues rate. As I see it, it is a more formidable challenge to form a local HUG in an area remote from a Heathkit store. Certainly, support from a store may not be required, or even desired in certain circumstances. But when you want it, and they're willing to give it—it's nice to have it!!

So if you're considering forming a local HUG, you need lots of enthusiasm, lots of cooperation, a group of volunteers willing to work hard, and plenty of luck. But if it works out successfully, it's worth all the effort you invested!

Additional Information

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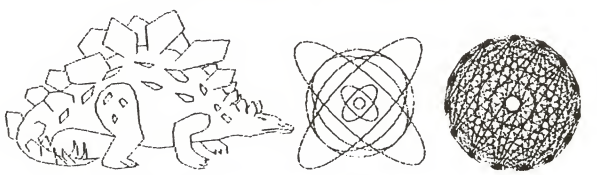

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• **EFC - The Electronic Filing Cabinet** is a screen-oriented database storage/retrieval package for Z-DOS. EFC is a low cost data storage and retrieval package for any type of personal data. EFC DOES NOT do any manipulation of data type you record. (ie, SORT, etc...). Data is stored in common "screen sized pages" and recalled by selecting the pages desired. EFC is human engineered and completely menu driven for ease of use. The Electronic Filling Cabinet is $39.97

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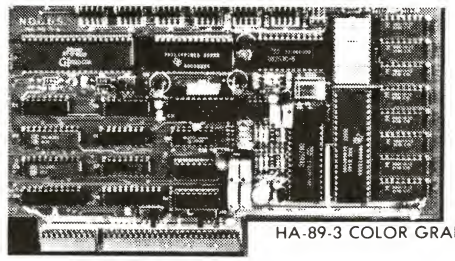

HA-89-3 COLOR GRAPHICS BOARD

HA-89-3 COLOR GRAPHICS BOARD.....**$299.00**

This board will expand your H/Z-89 computer to include color graphics and sound effects with support for both HDOS and CP/M. High level application support under GRAPH-PAC-II (see description below), and all for a price much lower than other boards offering much less! Uses the advanced TMS-9918A Color Video Generator which displays brilliant color graphic output on any video device accepting NTSC signals. Included is a documentation package which contains a distribution disk with sample programs and driver routines, a 275-page manual with detailed information on installing and using the HA-89-3, a schematic, manufacturers' data sheets for the major components of the board, and a list of vendors who have commercial software packages available for this board. The standard board includes:

- Eight Analog/Digital Converter Channels
- Sound Generation for Special Effects
- 16-Bits of Parallel I/O
- Three Counter Timer Channels
- Priority Interrupt Controller

Optional Features Include:

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- **Joysticks (each)**.....**$ 14.00**

Add $15.00 extra if options are not purchased with basic board.)

Please specify operating system (HDOS or CP/M) and disk format (any standard Heath format).

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Create color graphics and sound effects on your H-8 computer. Supports HDOS and CP/M and high level applications with GRAPH-PAC-II (see description below). Uses the advanced TMS-9918A Color Video Generator which displays brilliant color graphic output on any video device accepting NTSC signals. The programmable sound generator makes a wide variety of sounds. Included is a documentation package which contains a distribution disk with sample programs and driver routines, a 250-page manual with detailed information on installing and using the HA-8-3, a schematic, manufacturers' data sheets for the major components of the board, and a list of vendors who have commercial software packages available for this board. The standard board includes:

- Eight Analog/Digital Converter Channels
- Sound Generation for Special Effects
- 16-Bits of Parallel I/O

Optional Features:

- **Am9511A Arithmetic Processor (floating point and trig functions)**.....**$175.00**
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Allows your system to produce 8-part harmony in stereo rather than 4-part described above. Requires 4 MHz Processor. May also be ordered separately for existing HA-8-2 boards.

GRAPH-PAC-II.....**$ 39.00**

A software support package for the HA-89-3 and HA-8-3 Color Graphics Boards described above.

- Supports calls from:

  ASSEMBLY LANGUAGE (requires M-80)
  BASIC-80 (interpreter or compiler)
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Package includes your choice of one of the above languages. Additional languages may be ordered for $15.00 each. Please specify language(s), disk format and operating system.

PASCAL/MT+ for HDOS.....**$350.00**

Contains six major components: compiler, linker, debugger, disassembler, librarian and distribution package. The recommended environment is 64K of memory (the Pascal/MT+ compiler will use the lower 8K for additional symbol table space), three 100K disks or two extended density disks.

- Supports entire ISO standard (DPS/7185)
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Turn Your Computer into an Electronic Typewriter

A short program in Benton Harbor BASIC provides ample word-processing power for much personal correspondence. Both disk and cassette versions are provided.

Thomas G. Bohon

At home, one of the most time-consuming functions I perform is that of answering or writing letters. It seems as if I'm always dragging out the fifteen-year-old portable typewriter, typing a line, correcting the mistake(s) I invariably make, typing the next line, ... You get the picture!

Then, as if that procedure isn't bad enough, I have to try to type the envelopes, something my old, tired typewriter doesn't like to do. When I began making noises like I wanted a new electronic typewriter, my wife pointed out that I already owned a $3,000+ electronic typewriter—so why wasn't I using it...?!

As originally configured, my Heath H8 system—purchased three years ago—consisted of 24 kilobytes of random-access memory (RAM), dual cassettes, and an H9 terminal. Frankly, it wasn't of too much value for serious computing—certainly not what I was used to at work. Gradually, over the past three years, I've expanded the system until I now have an H14 printer, 64K of RAM, and dual floppies. As the system has evolved, so too have my uses for it in my home.

So, to satisfy my need for a typewriter, and to keep peace in the household, I wrote a letter- and label-writing program for my H8. I could, I suppose, have gone out and bought word-processing software. But I felt that my needs were sufficiently limited that I should be able to do the job on my own. Besides, I still use my cassette system and enjoyed turning out something that would work with both cassette and disk.

The program I wrote is shown in Listing 1. (This is the cassette version. Listing 2 is the version for use with a disk system.)

Called Letter/Label Writer, this is a simple program, designed under memory capacity restraints and using only standard BASIC functions.

Basically, the program turns your system into a correctable, previewing typewriter system—not a fancy word processor, you understand, but certainly good enough for normal household use. An additional feature of this particular program is that you can print a number of pages of letters; then, without running another program, produce the necessary mailing labels for those letters. I like the program (of course, I am prejudiced) and use it a great deal.

A look at the program

The first thing to note in the program is that it is almost entirely devoid of the bells and whistles normally found on word processors. The reason for this lack of amenities is quite simple—when the program was originally written, I had only 16K of RAM, with BASIC taking up 12K. Memory constraints prohibited a lot of the "nice to have" features. Even without these, however, I think you'll find this program more than adequate for your needs.

Program execution begins with the printing of the program name. All of working storage is CLEARed and an array, A$, defined to hold the text. The program then solicits the text, one line at a time.

As it is entered, each line is checked to see if it is either too long or consists solely of the double backslash (\\), which is used as the termination code. If the line consists solely of this flag, the program branches to line 140 where the review process begins.

If the line is normal text but is too long, it is searched from back to front to determine where to break it after a complete word. If a break point is found,

```
00010 PRINT "LETTER/LABEL WRITER":PRINT
00020 CLEAR :DIM A$(55):N=0
00030 PRINT "BEGIN INPUT (\\ TO END)":PRINT
00040 N=N+1:IF N>55 THEN PRINT "PAGE FULL!";CHR$(7):GOTO 140
00050 PRINT N;:LINE INPUT ">  ";A9$
00060 IF LEFT$(A9$,2)="\\" THEN N=N-1:PRINT "END INPUT":GOTO 140
00070 IF LEN(A9$)<=65 THEN 130
00080 F=0:GOSUB 361:IF F<>0 THEN 50
00130 A$(N)=A9$:GOTO 40
00140 PRINT :PRINT "PREVIEW FOLLOWS--NOTE ERROR LINE NUMBERS!";CHR$(7)
00150 FOR I=1 TO N:PRINT I;">  ";A$(I):NEXT I:PRINT
00160 INPUT "LINE # TO CHANGE (0 TO END)?  ";Z9:IF Z9=0 THEN 210
00170 PRINT "CURRENT LINE:":PRINT A$(Z9):L9=LEN(A$(Z9))
00180 PRINT "NEW LINE":LINE INPUT "?  ";A9$:IF LEN(A9$)<=65 THEN 200
00190 F=0:GOSUB 361:IF F<>0 THEN 180
00200 A$(Z9)=A9$:GOTO 160
00210 PRINT :PRINT "READY PRINTER, HIT ANY KEY...";:PAUSE :PRINT
00220 PORT OUT 224,4800:FOR I=1 TO 5:PRINT:NEXT I
00230 FOR I=1 TO N:PRINT TAB(9);A$(I):NEXT I:PRINT CHR$(12)
00240 PORT OUT 250:LINE INPUT "ANOTHER PAGE/LETTER (Y/N)?  ";A1$
00250 IF LEFT$(A1$,1)="Y" THEN 20
00255 LINE INPUT "LABELS (Y/N)?  ";Z1$:IF LEFT$(Z1$,1)<>"Y" THEN 370
00260 PRINT :PRINT "INSERT LABELS, HIT ANY KEY...";:PAUSE :PRINT
00270 PORT OUT 224,4800:OUT 224,27:OUT 224,117:OUT 224,16:PORT OUT 250
00280 LINE INPUT "NAME?  ";N$:IF LEN(N$)=0 THEN 370
00290 LINE INPUT "TITLE/COMPANY?  ";T$:LINE INPUT "ADDRESS?  ";A1$
00300 LINE INPUT "CITY?  ";C$:LINE INPUT "STATE (2)?  ";S$
00310 LINE INPUT "ZIP CODE?  ";Z$
00320 PRINT N$:IF LEN(T$)>0 THEN PRINT T$
00330 PRINT A1$:PRINT C$;TAB(27);S$
00340 PRINT TAB(24);Z$:PRINT :IF LEN(T$)=0 THEN PRINT
00350 PORT OUT 250
00360 GOTO 280
00361 FOR I=LEN(A9$) TO 1 STEP -1:A1$=MID$(A9$,I,1)
00362 IF A1$=" " THEN A9$=LEFT$(A9$,I-1):GOTO 365
00363 NEXT I
00364 PRINT "LINE TOO LONG, CAN'T TRUNCATE";CHR$(7):F=1:GOTO 369
00365 PRINT "LINE TOO LONG--TRUNCATED TO:":PRINT A9$
00369 RETURN
00370 PORT OUT 224,4800:OUT 224,27:OUT 224,117:OUT 224,1
00380 PORT OUT 250:PRINT "PROGRAM ENDS":STOP
```

Listing 1. Letter/Label Writer, cassette version. This Extended Benton Harbor BASIC program will allow you to type a letter, review it line-by-line for accuracy, and send it to your printer.

the line is truncated and you are notified so you will know where to begin typing for the next line. A break point, however, might not be found. This could happen if the line consisted of one long string, such as "=====...==". In such a case, an error message is output; and the same line is solicited again. After accepting a valid line, the program returns to line 40 and solicits the next line of text.

Once all text has been entered, the program gives an automatic review of the entire letter. This is accomplished in the routine beginning at line 140 and ending at line 150. Each line and its number is displayed and the operator is asked to observe whether any line contains an error to be corrected. After the review is complete, the program solicits the numbers of any lines to be changed. When a line number is entered, that line of text is displayed and the new (replacement) line is solicited. Note that the entire line must be re-entered, and that this new line is validity-checked as before. A line number of 0 terminates this function.

Once all errors have been corrected, the program instructs you to ready the printer. The page of text is then printed, a form feed is output, and if more letters or pages are to be prepared, the program branches back to the beginning of the routine.

Note that on the output, an indentation of eight spaces (approximately one inch) is automatic for each line—as is a one-inch margin at the top of each page. These values can be changed when you type the program into your system. (The tab in line 230 determines the indentation. Line 220 determines the upper margin.)

Upon completion of all letters/pages, the program queries the user to determine if labels are to be printed. If you respond with a "Yes," the program prompts you to set up the printer with the labels and to hit any key.

Once the printer is ready, the program solicits and prints one label at a time. Each label consists of five lines: Name, Title/Company/Comment, Address, City and State, and ZIP code. A null value (i.e., a carriage return) for the name field will terminate the function and program execution.

The program has been extremely useful to me, and I think you'll wonder how you got along without it once you've used it for a while. I use mine a great deal on a daily basis, and I'm pretty sure it's "bug free." So if you find something that doesn't seem to work just right, I'd appreciate hearing from you. Good luck!

```
00010 PRINT "LETTER/LABEL WRITER":PRINT
00020 CLEAR :DIM A$(55):N=0
00025 E$=CHR$(27)+CHR$(117):E2$=E$+CHR$(16):E1$=E$+CHR$(1)
00030 PRINT "BEGIN INPUT (\\ TO END)":PRINT
00040 N=N+1:IF N>55 THEN PRINT "PAGE FULL!";CHR$(7):GOTO 140
00050 PRINT N;:LINE INPUT ">  ";A9$
00060 IF LEFT$(A9$,2)="\\" THEN N=N-1:PRINT "END INPUT":GOTO 140
00070 IF LEN(A9$)<=65 THEN 130
00080 F=0:GOSUB 361:IF F<>0 THEN 50
00130 A$(N)=A9$:GOTO 40
00140 PRINT :PRINT "PREVIEW FOLLOWS--NOTE ERROR LINE NUMBERS!";CHR$(7)
00150 FOR I=1 TO N:PRINT I;">  ";A$(I):NEXT I:PRINT
00160 INPUT "LINE # TO CHANGE (0 TO END)?  ";Z9:IF Z9=0 THEN 210
00170 PRINT "CURRENT LINE:":PRINT A$(Z9):L9=LEN(A$(Z9))
00180 PRINT "NEW LINE":LINE INPUT "?  ";A9$:IF LEN(A9$)<=65 THEN 200
00190 F=0:GOSUB 361:IF F<>0 THEN 180
00200 A$(Z9)=A9$:GOTO 160
00210 PRINT :PRINT "READY PRINTER, HIT ANY KEY...";:PAUSE :PRINT
00220 OPEN "LP:" FOR WRITE AS FILE #1:FOR I=1 TO 5:PRINT #1,:NEXT I
00230 FOR I=1 TO N:PRINT #1,TAB(9);A$(I):NEXT I
00235 CLOSE #1
00240 LINE INPUT "ANOTHER PAGE/LETTER (Y/N)?  ";A1$
00250 IF LEFT$(A1$,1)="Y" THEN 20
00255 LINE INPUT "LABELS (Y/N)?  ";Z1$:IF LEFT$(Z1$,1)<>"Y" THEN 370
00260 PRINT :PRINT "INSERT LABELS, HIT ANY KEY...";:PAUSE :PRINT
00270 OPEN "LP:" FOR WRITE AS FILE #1:PRINT #1,E2$
00280 LINE INPUT "NAME?  ";N$:IF LEN(N$)=0 THEN 370
00290 LINE INPUT "TITLE/COMPANY?  ";T$:LINE INPUT "ADDRESS?  ";A1$
00300 LINE INPUT "CITY?  ";C$:LINE INPUT "STATE (2)?  ";S$
00310 LINE INPUT "ZIP CODE?  ";Z$
00320 PRINT #1, N$:IF LEN(T$)>0 THEN PRINT #1,T$
00330 PRINT #1, A1$:PRINT #1,C$;TAB(27);S$
00340 PRINT #1, TAB(24);Z$:PRINT #1, :IF LEN(T$)=0 THEN PRINT #1,
00360 GOTO 280
00361 FOR I=LEN(A9$) TO 1 STEP -1:A1$=MID$(A9$,I,1)
00362 IF A1$=" " THEN A9$=LEFT$(A9$,I-1):GOTO 365
00363 NEXT I
00364 PRINT "LINE TOO LONG, CAN'T TRUNCATE";CHR$(7):F=1:GOTO 369
00365 PRINT "LINE TOO LONG--TRUNCATED TO:":PRINT A9$
00369 RETURN
00370 PRINT #1,E1$:CLOSE #1
00380 PRINT "PROGRAM ENDS":STOP
```

Listing 2. The disk version of Letter/Label Writer. Lines 10–20, 30–210, 250–260, 280–310, and 360–369 are common to both these listings.

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Put an Electronic Disk into Your H8

The X/2-H8 memory controller from Trionyx gives you rapid, silent access to files.

Thomas R. Sear

Trionyx Electronics has pledged ongoing support for the H8 computer. And if their new X/2-H8 Memory Bank Select Board is any indication, the future looks bright for H8 owners. This new half-board allows you to add up to three new banks of random-access memory (RAM). At up to 64 kilobytes each, plus the 64K upper limit the H8 already has, that gives you an upper limit of 256K RAM. It makes the H8 a machine for the future.

I have been working with the X/2-H8 for some time, and I believe it is the most significant improvement ever built for the H8.

Even with 64K RAM installed in my H8, I had pushed the upper limits of the machine's memory many times. Also, I had been annoyed by the constant noise when my programs accessed the disk drives.

The new board does three major things. First, it reduces disk-drive operation to almost nil. Next, as noted, it allows the H8 to utilize up to 256K of memory. And third, it provides for storing multiple programs within RAM for instant recall at any time without repeatedly accessing the disk drive. In applications involving repeated use of device drivers, and RENUMBERing completed programs, this latter mode of operation makes the board well worth the cost. In various educational programs that I run, there used to be undesirable delays involved when the disk had to be accessed to drive either the printer or the Votrax speech synthesizer. With the X/2-H8 installed, such delays are no longer noticeable. And, obviously, not listening to disk-drive operation lets the student concentrate more on the lesson. (For a similar board for the H/Z89, see Hal Glatzer's article in *Sextant* #6, Summer 1983, "Taking a Look at Magnolia's Invisible Disk.")

The X/2-H8 gives you two powerful new modes of operation, known as MU: and CACHE:. MU: is basically an internal high-speed electronic "disk." You treat it just as you would a disk. CACHE: is basically an internal "holding area." As you access data or programs they are automatically placed in RAM, to be available for later high-speed recall without accessing the external disk drives.

In the MU: mode, the H8 is able to utilize up to 256K of memory. Besides its greater speed, the main difference between MU: and a disk is that MU is not bootable.

In the CACHE: mode, the H8 uses up to 64K of main memory, and 64K, 128K, or 192K of extra memory for storing all files read from the disk drives. Once read, these files are held in the CACHE: and are automatically recalled when needed without activating the disk drives. Various tests that I have run indicate that files are loaded from CACHE: in less than half the time that is required to obtain them via the disk drives. (In the case of device drivers, it is essentially instantaneous.)

I estimate that disk operation is reduced more than 90% in my system.

Either mode allows for storage of multiple programs (such as LP:DVD, VX:DVD, or RENUMBER) at power-up, with no further need to operate the disk drives while running programs for extended periods. When program development is completed, you simply transfer any pertinent data to the external drives for permanent storage using standard commands. Both modes of operation are "user friendly": one need not learn any new formats to use them. And, only a few simple hardware modifications are required—mainly connecting the X/2-H8 control outputs to the system memory boards.

The MU: mode

Operating in the MU: mode provides an excellent way to utilize extra 8K and/or 16K memory boards. Unlike the CACHE: mode, which requires that a given bank of memory contain 64K, MU: will operate with as little as 16K in a bank. However, each bank must contain 64K before another bank will be used in either mode. This does not include the main memory, the CPU bank, which will operate with only 16K installed. However, the Heath Disk Operating System (HDOS) uses up 24K of CPU memory; so the size of your files will determine how much CPU memory your system must have. I recommend installing 64K and forgetting about it.

In the MU: mode, memory not used as CPU memory is essentially an internal high-speed electronic disk. You INITialize MU: as you would a floppy disk, and then use it in the same way using the same command format as you would with a floppy disk. There are a number of advantages: it is faster than an external disk; it can be as large as 192K; it virtually eliminates external disk operation during program development; and all files created using it can be transferred to external floppy disks for permanent storage using standard disk commands. Support files, such as LP:DVD, can be transferred to MU: as desired for use during program development, etc.

MU: is the best mode to use when developing new files, since it provides up to 256K of memory, and is the only mode you can use if you don't have enough memory boards to fill even a single bank with 64K. MU: will operate with only 16K in a given bank, so it is possible to fill one bank to 64K and another bank with only 16K. This configuration will still function as an electronic disk, giving you approximately 55 sectors for each 16K installed.

The CACHE: mode

In the CACHE: mode, the extra memory banks become an automatic storage area. All files read from the external disk, as you work, are placed in the CACHE:. Any time a file is called for, the H8 checks CACHE: first. If the file is stored there, it will be read from there rather than the external drive. If it isn't, the external drive will be accessed and the file will be placed in CACHE: at the same time it is read into the CPU memory area. Eventually, CACHE: will contain all the files you need and the external drive just sits quietly off to the side. I estimate that disk operation is reduced more than 90% in my system.

To use CACHE:, a given bank *must* contain 64K of memory. Again, this does not include the CPU bank, BANK 0. BANK 1 must be filled first, followed by BANK 2 and BANK 3 in that order. During BOOT, at

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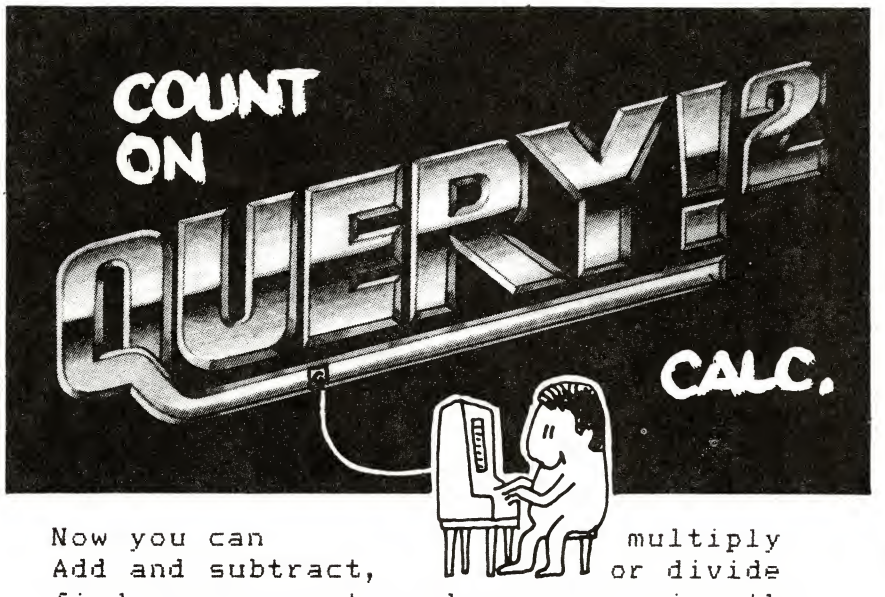

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the HDOS prompt, CACHE: is installed by typing CACHE:. After a short pause, during which the X/2-H8 is sizing the available memory, the amount of CACHE: installed will be displayed. (This will be either 64K, 128K, or 192K, nothing else. If a bank doesn't contain 64K it will be ignored.) Once CACHE: is installed, you operate your system as you always did. CACHE: will automatically take care of storing all the files that you use so they are ready for future use.

There is no command, such as BASIC's FREE, to determine how much CACHE: remains after you begin to use it. You can handle this problem in either of two ways. If you know how large various files are, you can jot down a running total of how much CACHE: has been filled. I'll admit this isn't too likely.

The other way is to "monitor" the first file placed in CACHE:. CACHE: sort of "pushes" new files into CACHE: from the "bottom"; and as it is filled, the first file placed there will be the first file "pushed" out the "top." By calling the first file now and then, you can tell whether CACHE: is filled. When the file is no longer installed, you will hear the disk being accessed. I haven't found this to be a problem yet. I have 64K of CPU memory, and 128K of CACHE; and I have never been able to fill CACHE:. I have tried. I have loaded in various device drivers, several long games (such as Spacewar), and many class handouts all at once; and I have never lost any files or been unable to run a program.

X/2-H8 and H8 configurations

The most important fact about configuring for the X/2-H8 is that your H8 *must* be set up for org–0, the standard CP/M configuration (where the first page of user RAM begins at 100 hex). Most, except some of the older H8s, are set up for org–0, so this is not addressed directly in the Trionyx instructions. My H8 was an exception and would not operate reliably until I discovered and corrected the omission. A call to Trionyx quickly cleared the air; they are a very cooperative group.

The X/2-H8 can be obtained either pre-wired or as a kit. If you prefer to build your own, you should read through the assembly instructions several times before beginning. This is because several jumpers must be installed according to a number of conditions: whether you have the original Heath motherboard or the Trionyx model; the types of memory boards in the system (the Heath 64K board is the problem here since it uses a positive control voltage, while all others appear to use a negative control level); and, if you have the Trionyx motherboard, whether you choose to use an "A" or a "C" connector as discussed below. (See *Sextant* #5, Spring 1983, for my review of the Trionyx motherboard, "Improve Your H8's Reliability: Install a

Trionyx Motherboard.")

(Unless you get all the connections straight before you begin, it can be a little confusing. I hope this article saves you some time in the matter.)

Trionyx builds the X/2-H8 for immediate installation in the H8 with an original motherboard and any memory board except the Heath 64K model. If you fit this category, all you need to do is configure your memory boards per the instructions provided, install the twisted-pair control wires on the memory boards, connect the memory boards to the X/2-H8, and apply power to the system. BOOT the system using the software disk provided, and you are in business.

If you are using any Heath 64K memory boards, all you need do is change one jumper on the X/2-H8 for each 64K board that you have, and proceed as outlined above.

If you have a Trionyx motherboard, you have the option of using either an "A" or a "C" connector. The "A" connector corresponds to the original Heath motherboard connectors.

If at all possible, you should use a "C" connector if a Trionyx motherboard is involved. This allows you to use connector P11, located just behind the CPU board. This connector was apparently added by Trionyx to its motherboard for just such a need as this. Using P11 places the X/2-H8 in front of all the memory boards as Trionyx recommends. Doing so avoids having long control wires. Moreover, the exact position of the various boards helps to increase or decrease interference between them. So going along with the recommended locations pays off in operating stability.

You will then have to move the jumper on pin 45 of the X/2-H8 to pin 43; then install two jumpers on the motherboard to connect A-45 to C-43, and A-44 to C-44. This last should be done on a pair of connectors near the front of the H8, and can be done from the rear (by removing the motherboard from the H8) or via the connector pins on the front surface of the motherboard. If small wire is used, boards still fit nicely onto the motherboard. Once this is done, all you have to do is modify the memory boards as mentioned below, and apply power to the system.

If you are using Heath 64K memory boards, the Trionyx instructions tell you to disable pin 9 of U60. You will find that the Heath board doesn't have a U60. It was to be part of the circuitry for extended addressing, which Heath never got around to doing. I am running Heath 64K boards, and I just connected the control wires to pins 8 (black) and 9 (white) of the socket for U60.

If you decide to use one of the "A" connectors, you will probably want to use connector P10 on the motherboard. Again, this is not advisable if you have the Trionyx motherboard. But P10 was "reserved" on the original Heath motherboard for future expansion and is seldom used. Using it will seem better than wasting an otherwise useful connector on the center of the motherboard. However, this will mean long control wires (not recommended) if you leave the memory boards at the front of the H8 as recommended by Heath. If at all possible, Trionyx recommends that the X/2-H8 be in front of the memory boards. If you use an "A" connector, simply proceed as previously outlined for a standard H8 configuration.

If you plan to build your own board, pay special attention to steps 5 and 14 in the assembly instructions. Step 5 deals with the installation of the jumpers discussed above, and it requires some digging through the material provided to figure out just which jumper goes where. The information given above should make this clearer. Step 14 deals with the control wire pairs. Trionyx supplies four complete cables with the X/2-H8. They are assembled if you buy your board pre-assembled, and the parts are provided if you elect to build your own. In either case, make certain that you connect the correct end of the cable to the X/2-H8. This is the end which has a white wire installed in the center-pin of the connector. The other end has a wire in pins 1 and 3 of the connector, and is to be used when connecting to the Trionyx memory board. The ends of the

A note for CP/M users

Those who use the X/2-H8 board under the Heath Disk Operating System (HDOS) will frequently prefer its CACHE mode. As noted in the text, this was the preference of the reviewer; and Trionyx reports that most of their HDOS customers share that view.

Under the CP/M operating system, however, the CACHE mode tends to be quite a bit slower than the MU mode. This is because of fundamental differences between the two operating systems.

Under HDOS, disks can be changed only by the DISMOUNT and MOUNT process. The operating system thereby has continuous access to accurate file-directory information.

Under CP/M, disks can be changed without telling the operating system. So in order to ensure disk-file protection, CACHE has to go to CP/M to re-check the directory. The MU mode, however, keeps track of its own files. It need not go to the operating system except for a warm boot.

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wire-pair connected to most other memory boards will be soldered to specified points, so there isn't much chance of a problem in that area.

System checkout

When you are ready to install the X/2-H8, I recommend the following procedure. Install the X/2-H8 and the CPU memory boards; leave all other memory boards uninstalled for now. Be certain that the X/2-H8 is installed with the component-side toward the rear of the H8. This is facing in the direction opposite to that of all the other boards. Connect the CPU memory board to the X/2-H8 CN3 (BANK 0) connector. Be certain that all three pins go into the connector; it is easy to miss one. Then BOOT the system and run the X2LIGHT and X2WALK tests supplied on the software disk provided by Trionyx. The X2LIGHT test will cause the light-emitting diodes (LEDs) on the bank-select board to sequence in a binary count from 0 to 15. The X2WALK test will cause the LEDs to "walk" back and forth from side to side. These two checks verify pretty well that the system is operating normally, and that it is selecting the various banks of memory as it should.

DISMOUNT and remove the disk, turn the power off, and install the remaining memory boards. Re-BOOT the disk, and run the CACHE: and MU: checks. These two tests verify that the entire system is still operating normally.

Problems that might appear at this point include failure for a bank to select, or not getting all the CACHE: that you feel you should. In the first instance, make certain that the connectors are installed on the X/2-H8 pins correctly, and that you are connected to the memory boards at the correct points. The CACHE: may surprise you unless you remember that CACHE: will only install a bank that contains 64K. If your memory has even one defective chip, that will be enough for CACHE: to display NO MEMORY AVAILABLE. You can check this by going to the MU: mode. Remembering that you should get about 55 sectors for each 16K of memory when you DIR MU:/S, it is possible to test a 64K bank to see if it is failing mid-way through.

One user's comments

I have been very impressed with the X/2-H8 board. If it is a sample of what Trionyx will be providing in the future, I expect to keep my H8 system for a long time. I have used the board in both modes, but find that the CACHE: mode is my favorite. I usually install all of the files that I expect to use when I first power-up the system; this is mainly because I thoroughly dislike hearing the disk drives accessing.

I have found that if I use CACHE: simply to install files as I might call for them, that the drives tend to take longer to settle down. During the process of getting to know the X/2-H8, I discovered that if I load all of the files that I think I will be using, and then run the CACHE test program (CATEST) provided by Trionyx, the disks are not accessed at all until I call for another file. Then it takes a while to stop accessing the drives, unless I rerun CATEST. It seems to work, I don't know why. I haven't discussed it with Trionyx because the system eventually stops accessing the drives as it should, anyway—this little hint just speeds it up somehow.

I have found that relying on only 48K of main memory is pushing things. By the time you consider the memory requirements of HDOS, etc., it seems that 64K is the only way to go. I should mention, though, that my system has been required to handle a large amount of data. That may be why I went to 64K for the CPU. Others may find that a lesser amount will suffice.

Overall, I rate the X/2-H8 excellent in all aspects of workmanship and electronic operation. I believe that this half-board is the best addition that can be installed in an H8, and recommend it to all H8 owners who plan to expand their system to the maximum.

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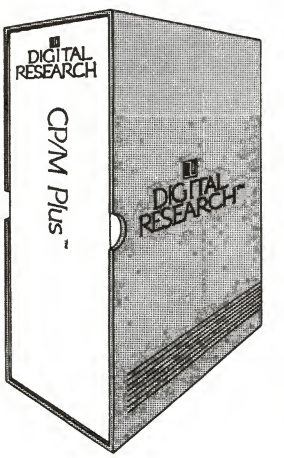

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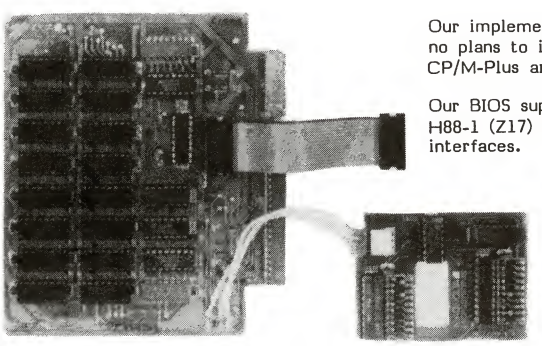

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Doctor Your Daisywheel Device Driver

Improvements designed for the HDOS ATH44 device driver may also be adapted for other applications.

Charles E. Cohn

Your printer is all set up. The paper is at top-of-form and you start printing. Well, not quite. First of all, the printer zips out that first sheet and only starts printing on the next one. It can be annoying, as well as wasteful.

It can be annoying, too, to see your printer stepping out superfluous spaces at the end of a line, going all the way to the margin.

Problems such as these can be corrected, without a lot of difficulty, by modifying the device driver that runs the printer. My printer is a Diablo, and its driver is ATH44, one of the device drivers that comes with version 2.0 of the Heath Disk Operating System (HDOS). ATH44 is adequate for most work. But there is a lot of room for improvement. The improvements to be described here are designed to increase the driver's usefulness and make it much nicer to work with.

And although this article is written for HDOS's ATH44 and the Diablo, I think that some of these improvements could also be useful for other printers and other operating systems.

The improvements presented here are as follows:

1. Saving paper by eliminating superfluous form feeds which occur when the paper is already at top-of-form.
2. Saving time (as well as wear and tear on the printer) by suppressing any superfluous spaces at the end of a line.
3. Correction of a bug that now results in the improper handling of certain escape sequences.
4. Getting the most out of the printer's buffer by adjusting the driver's buffer count.

Superfluous form feeds

The first improvement is intended to save the sheet of paper that is wasted whenever a form feed is executed with the paper already at top-of-form. It takes advantage of the Diablo's ability to do backward line feeds. This change involves doing a backward half-line feed before each form feed. If the paper is already at top-of-form, the backward feed will move it back from that position, and the subsequent form feed will just move it up to where it was before.

This idea, which I believe to be original, may be used with any printer that can do backward line feeds. For the Diablo, it is accomplished by sending the printer an ESCape-D.

If, for any reason, you actually want to feed out an extra sheet, your application program can output one or more newline characters between two form feeds. (The Diablo, like most modern printers, keeps track of top-of-form by counting line feeds, in accordance with the form length that has been switch-selected and the initial top-of-form that the operator has set.)

Superfluous spaces

Superfluous spaces at the end of a line may arise, for example, in a BASIC

```
WRI1    MOV     A,B
        ORA     C
        RZ                      THE LAST BYTE HAS BEEN WRITTEN
        CALL    CFA
        JNZ     ABORT           AN ABORT WAS HIT ON THE CONSOLE
        LDAX    D
        CPI     ' '             IS NEXT CHAR A SPACE?
        JE      WRI3            IF SO, GO TO STEP SPACE COUNT
        CPI     FF              IS IT A FORM FEED?
        JE      WRI5            IF SO, START FORM FEED SEQUENCE
        CPI     NL              IS IT END OF LINE?
        JNE     WRI4
        XRA     A
        STA     D.SPCT          IF SO, ZERO SPACE COUNTER
        JMP     WRI2
WRI4    LDA     D.SPCT          FOR ANY OTHER CHAR, CHECK SPACE COUNT
        ANA     A
        JE      WRI2            IF NO SPACES WAITING, PRINT CHARACTER
        DCR     A
        STA     D.SPCT          DECREMENT SPACE COUNT
        XRA     A
        STA     D.LWE           CLEAR ESCAPE SEQUENCE FLAGS
        STA     D.NOC
        STA     D.LCS
        MVI     A,' '           AND PRINT A SPACE
        CALL    DBOUT
        JMP     WRI4            BACK FOR MORE SPACES
WRI3    LDA     D.SPCT          STEP SPACE COUNT
        INR     A
        STA     D.SPCT
        DCX     B
        INX     D               AND STEP BUFFER
        JMP     WRI1            BACK FOR ANOTHER CHAR
WRI5    LDA     D.LCS           WAS FF PART OF ESCAPE SEQUENCE?
        ANA     A
        JNE     WRI2            IF SO, PROCESS NORMALLY
        MVI     A,ESC           ELSE, SEND A BACKWARD HALF LINE FEED
        STA     D.LWE           BEFORE THE FORM FEED
        CALL    DBOUT
        XRA     A
        STA     D.LWE
        MVI     A,'D'
        CALL    DBOUT
WRI2    CALL    CES
        LDAX    D
        CALL    DBOUT
        DCX     B
        INX     D
        JMP     WRI1
```

Listing 1. Placed between WRI1 and WRI2, this coding will eliminate superfluous form feeds and spaces.

program that PRINTS a TAB followed by a string variable that happens to be null. Modified, the driver will suppress them by setting up a one-byte space count in memory and initializing it to zero. When the driver encounters a space code in the input stream, it does not transmit the code to the printer. Instead, it increments the space count. When it encounters a non-space character, it looks at the space count. If the count is not zero, it sends a space to the printer and decrements the count.

It repeats this until the count becomes zero, and then transmits the character. However, if the character is a new-line code, it clears the space count and transmits no spaces. Thus, a series of spaces of any length will be printed, provided that they are followed by a printable character on the same line. This idea would be useful for any serial printer that doesn't have that function already built in.

A bug

Certain non-printing characters are handled in a special way by ATH44 as it comes from Heath. Specifically, a line-feed character gives rise to a CR-LF sequence; a tab is replaced with an appropriate number of spaces; and a form feed resets the driver's line count. Such treatment is not always appropriate, as the special character may be part of an escape sequence. (Specifically, ESC-LF commands a backward full line-feed.)

In such a case, the character should be transmitted directly with no special action. To accomplish this, I beefed up the existing coding that analyzes escape sequences. As a result, the above-mentioned handling of form feeds is bypassed if the form feed is part of an escape sequence.

(The coding shown in the subroutine CES, Listing 2, is tailored for the Diablo 1620, where ESC-LF is a two-character sequence, while ESC followed by some other non-printing character forms a three-character sequence. The third character can be anything, since it specifies a count (a space or line count, say). If your printer's escape sequences do not follow that pattern, you will have to modify the coding, following CES2 in Listing 2, that recognizes two- and three-character escape sequences.)

The buffer

Heath programmed the driver for a printer with a 30-character buffer. However, my Diablo 1620 has a 158-character buffer. As a result, the driver wasted most of my Diablo's buffering ability, sending only 30 characters to the printer before initiating a handshake sequence. In this sequence, the driver sends an ASCII ETX (End-Of-Text) character to the printer. When the printer empties its buffer, it returns an ACK (Acknowledge) character to the driver. The driver then sends 30 more characters. I expanded this buffer count to 127 characters, the maximum possible the way the driver is programmed, as I explain below.

The driver was originally programmed to sit in a loop waiting for the ACK. I reprogrammed it to return to the calling program after sending the ETX if there is nothing more to be printed, so the waiting time may be used productively. You can take advantage of that in your assembler-programmed applications if you perform .WRITE calls to the printer

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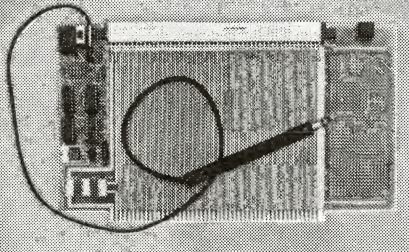

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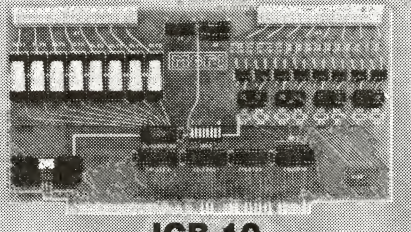

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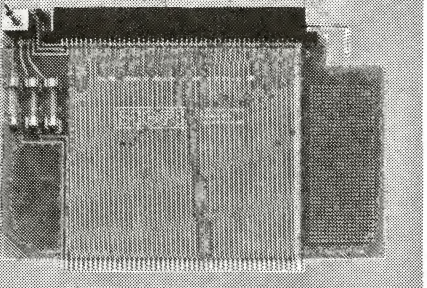

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with a character count of 1 every time you have a character ready. Since the printer has a buffer, there is no need for your program to provide one; so you save the memory space taken up by a buffer, as well as the coding needed to maintain it. Also, you make better use of the printer's buffer in overlapping printing and computation.

The improved driver, like the original Heath version, permits but does not necessitate bidirectional printing. Most printers designed for bidirectional printing will store and re-order characters appropriately.

Implementing the improvements

If you wish more background on device drivers, a good reference is "The HDOS Device Driver Programmer's Guide" from the Heath Users' Group (HUG). It originally appeared in *REMark*, Issue #20, September 1981. And HUG has also published it separately as HUG part number 885-1018.

To modify and reassemble the driver, you will need the file ATH44.ASM from Heath's Device Drivers disk; as well as the ACM files TBRA, TYPTX, and U8250 from that disk; and ASCII, DDDEF, DEVDEF, DIRDEF, DVDDEF, DVDIO, ECDEF, ESINT, ESVAL, FILDEF, HOSDEF, HOSEQU, MTR, PICDEF, and SETCAL from the Software Tools disk.

You will also need, of course, the assembler and your favorite editor. You can get all this on one disk and do the job in a single-drive system if you use stand-alone operation, as I have described in other articles. ("Squeeze More Disk Space out of HDOS," *Sextant* #6, Summer 1983; and "More on HDOS STAND-ALONE," *Sextant* #9, March-April 1984.)

To implement these improvements, first replace the coding between WRI1 and the end of the subroutine WRI2 with the coding found in Listing 1. This will handle the elimination of superfluous form feeds and spaces.

```
CES     LDA     D.LWE
        ANA     A
        JNZ     CES2            LAST CHARACTER WAS ESCAPE
        LDA     D.NOC
        ANA     A
        JNZ     CES1            NEED ONE CHARACTER
        LDA     D.LCS           LAST CHARACTER IN 3-CHAR SEQUENCE
        ANA     A
        JNE     CES4
        LDAX    D
        CPI     ESC
        RNZ                     LET A NORMAL CHARACTER SLIP THROUGH
        STA     D.LWE           FLAG LAST CHARACTER AS ESCAPE
        RET
CES1    STA     D.LCS
        XRA     A
        STA     D.NOC           ZERO NEED ONE CHARACTER FLAG
        RET
CES4    XRA     A
        STA     D.LCS
        RET
CES2    LDAX    D
        CPI     NL              ESC-NL IS A 2-CHAR SEQUENCE
        JE      CES3
        CPI     ' '
        JC      CES3
        XRA     A
CES3    STA     D.NOC           SET NOC FLAG, TRUE FOR ESC. SEQ. < ' '
        XRA     A
        STA     D.LWE           ZERO LAST CHARACTER WAS ESCAPE FLAG
        RET
```

Listing 2. Replacement for the subroutine CES. This corrects the handling of escape sequences.

Replace the coding of the subroutine CES with the coding in Listing 2. This corrects the handling of escape sequences.

Replace the first instruction in the routine DBOUT (CPI CR) with Listing 3a. This will correct the handling of non-printing characters in escape sequences.

To correct the handling of ETX-ACK handshakes, delete the subroutine CHP. In the subroutine DBOUT, replace the line

```
DBO9    ANI     177Q
```

with the coding in Listing 3b.

Next, insert the coding of Listing 3c between the lines

```
        STA     D.BURC
```

and

```
        RET
```

In the routine OPENW, following the instruction STA D.LINX, insert the line:

```
        CALL INCHAR
```

This will remove any acknowledge character that may remain in the buffer. It will prevent a buffer overrun when a print operation is started after a previous print operation has been aborted.

Then, near the end of the program,

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following the definition of D.NOC, define the variables found in Listing 3d.

To improve the utilization of your printer's buffer, equate the label BURST to the buffer length of your printer less 4, but no more than 127. (This is the number of characters that the driver counts out before sending an ETX character to the printer and waiting for the printer to empty its buffer and return an ACK character.) The "less 4" is to allow for the driver's being programmed not to transmit an ETX character in the middle of an escape sequence. (The printer would not handle the ETX properly at that point, and would hang up.)

```
DBOUT   EQU     *

        PUSH    PSW             SAVE CHARACTER
        LDA     D.NOC           IF AN ESCAPE SEQUENCE IS ON
        ANA     A
        JNE     DB06            BYPASS SPECIAL HANDLING OF CHARACTERS
        LDA     D.LCS
        ANA     A
        JE      DB07
DB06    POP     PSW
        JMP     DB05
DB07    POP     PSW
        CPI     CR
```

Listing 3a. Listings 3a–3d correct the handling of non-printing characters in escape sequences. Listing 3a replaces the first instruction (CPI CR) in the routine DBOUT.

```
DB09    PUSH    PSW             SAVE CHARACTER
        LDA     D.HSHK          WAS ETX SENT LAST TIME?
        ANA     A
        JZ      DB012           IF NOT, PROCEED TO OUTPUT CHARACTER
CHP1    CALL    CFA             IF SO, WAIT FOR DIABLO TO RETURN ACK
        JZ      CHP2            RETURN IF ABORT CHARACTER WAS HIT
        XRA     A               BUT FIRST, CANCEL ETX FLAG
        STA     D.HSHK
        POP     PSW             AND GET RIGHT WITH THE STACK
        RET
CHP2    CALL    INCHAR
        JZ      CHP1            NO CHARACTER HAS BEEN RECEIVED YET
        ANI     7FH             STRIP PARITY
        CPI     ACK
        JNZ     CHP1            WAIT FOR AN *ACK* CHARACTER
        XRA     A               RESET HANDSHAKE FLAG
        STA     D.HSHK
        MVI     A,BURST
        STA     D.BURC          RESET BURST COUNTER
DB012   POP     PSW             RETRIEVE CHARACTER TO BE OUTPUT
        ANI     177Q            MAP OUT HIGH ORDER BIT, POSSIBLY
*                               SET FOR QUOTE
```

Listing 3b. Replacement for the line DB09 ANI 177Q in the subroutine DBOUT.

```
LDA     D.BURC
DCR     A
STA     D.BURC          UPDATE THE NUMBER OF CHARACTERS OUTPUT
RP                      NOT TIME TO SEND ETX
LDA     D.NOC
ANA     A
RNZ                     NEED ONE MORE CHAR. FOR ESC. SEQ.
LDA     D.LWE
ANA     A
RNZ                     LAST CHAR. WAS START OF ESC. SEQ.
MVI     A,ETX
STA     D.HSHK          SET HANDSHAKE FLAG
CALL    OUTCHAR
```

Listing 3c. This is inserted between the lines STA D.BURC and RET.

```
D.LCS   DB      0       LAST CHAR FLAG FOR 3-CHAR ESC SEQ

D.SPCT  DB      0       SPACE COUNT

D.HSHK  DB      0       ETX/ACK FLAG, <>0 IF ETX JUST SENT
```

Listing 3d. Variables to be defined. They are to be inserted following the definition of D.NOC.

The limitation of 127 results from the buffer count D.BURC being carried as a byte which is initialized to the buffer length and decremented with each character. Eight bits in binary should allow a maximum count of 255. However, the highest of the eight bits is used to indicate the sign of the number (zero is positive; 1 is negative).

When this count goes negative, the buffer is considered to be full. If the count byte were initialized to a number greater than 127, it would look like a negative number, so the buffer would be terminated after only one character. (The definition of BURST may be found near the beginning of the ATH44 program, in the section labelled SPECIAL CHARACTERS.)

Anything else?

Before you assemble the modified driver, you might well give some attention to the set options that allow you to specify page width and lines per page. Personally, I find it convenient to disable these SET options in the source program by equating their labels, DFLT.WD and DFLT.LP respectively, to zero.

The WIDTH option allows you to specify the width of your printing. However, this function will not work if you do underlining or boldfacing. Those types of printing cause the transmission of extra characters that the driver counts in determining the width, although they do not contribute to the actual printout width. If you do that type of printing, then, you would do well to disable the width function by SETting the WIDTH option to zero.

Furthermore, if your application programs take care of paging, you don't need the lines-per-page function. All it will do is cause broken pages and extra, unneeded form feeds. In that case, you should disable it by SETting the PAGE option to zero.

Also, you may well want to cut down on the useless printout you get with the assembly listing by deleting the LON G pseudo-op that occurs near the end of the source. All LON G does is allow printout of a couple of pages of the relocation bits that HDOS uses in adjusting instruction addresses when it loads the driver. You don't need those unless you are doing something really esoteric like patching the driver's object code.

With everything in place, and the driver source modified as described above, you can assemble it. If you gave the modified ATH44 the new file name ATH44A, say, you can use the assembler command line:

```
LP.DVD,LP:=ATH44A
```

After the assembly is complete, copy the object file LP.DVD onto your bootable disks.

You are then in business with the improved driver.

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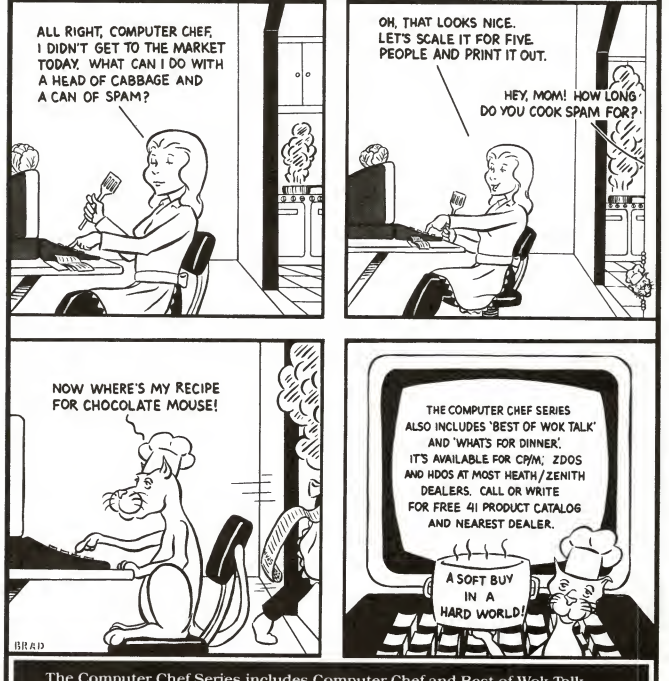
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EDUCATIONAL-UTILITY
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UD.COM - A Universal Printer Driver for CP/M

This is a printer driver/spooler that increases the printing capability of CP/M 2.2.xx. UD.COM has capabilities similar to UD.DVD and contains a built-in spooler that queues up to four files with multiple copies and opional titles and page numbering. (Specify CP/M or CP/M-85) $39.95

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This program modifies HDOS 2.0 to provide an expanded set of new commands and abbreviate many of the old ones. For example, MOUNT SY1: becomes M1, DISMOUNT SY1: becomes D1. New commands are added to print files, print the disk directory, change the disk label, create batch processing commands, enable the terminal scroll mode, copy files that contain hard read errors and show the free disk space. In addition, the disk directory is alphabetic, file dates remain unchanged when files are copied and a new date switch is added. Also included is a powerful file manager command which presents disk files one at a time and gives you a choice from 12 options to perform on the file. These include changing flags, viewing the first 24 lines, deleting and copying files and others. (HDOS) $29.95

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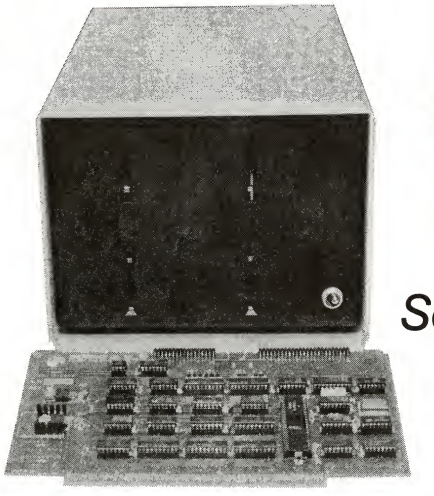

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Educational Software Roundup

"Educational" software is available for all ages—and for teachers as well as learners.

Frederick Zimmerman

Many of our readers have expressed an interest in educational applications for Heath/Zenith computers, so *Sextant* decided to conduct a survey of educational software. In October, we began writing to the various companies which *The Buss Directory* and the Zenith Data Systems H/Z100 *Software Directory* list as having educational software products. We also placed a notice in *Buss: The Independent Newsletter of Heath Co. Computers*. So we think we've covered most of the educational programs which are available. But if you know of any we've missed, we'd like to hear about them.

The Heath/Zenith educational software surveyed in this article can help **children and students** learn:

- the fundamental concepts and methods of arithmetic;
- the vocabulary of a foreign language;
- the essentials of United States and world geography;
- how to operate a business, using a simple model of the business marketplace.

Educational software can help **adults** learn:

- the vocabulary of a foreign language;
- computer programming in BASIC and in assembly language;
- how to operate popular applications programs (for example, WordStar, Multiplan, and dBASE II).
- the factors involved in the operation of a nuclear power plant.

Educational software can help **educators**:

- design courses which use computer-assisted instructional techniques;
- simplify their administrative tasks; such as keeping track of exam scores, making up report cards, and scheduling courses.

In the following survey, we'll try to summarize the pertinent information about each program. We will use a standard format for each software description.

Software description format

Program Name
Price; supplier
Disk formats available
On which Heath/Zenith computers will this program run? ("H8&19" indicates that the program requires an H8 computer with the H/Z19 terminal.) What is the minimum combination of random-access memory (RAM), disk drives, and other hardware devices which are necessary to run the program?
Under which disk operating system does this program run? In order to run the program, do you need any other software—programming languages, device drivers, text editors, and so forth?
Audience:
Running Time: When there is no *Running Time* heading, that means that the length of a program session can be varied as the user desires.
Description: What is this program supposed to do? And for whom? A brief answer.
Features: How does this program perform its function? What special capabilities does it have?
Performance: How efficiently, conveniently, and flexibly does this program perform?
Ease of Use: How difficult is it to learn the basic operations of this program? How much help does the program provide the new user? Is it possible to "crash" the program by entering incorrect input? When you do enter incorrect input, does the program explain your mistake?
Documentation: How much explanatory text is provided with the software? Are there indexes, glossaries, or other reference tools? How easy is it to understand? How comprehensive is it?
Other comments: Anything else we think is important or interesting.

Ordering information will be found at the end of this survey.

Categories

Computer education
Geography
Language drills
Math drills
For educators
Miscellaneous

Computer education

ATI Training Power
$75 each; American Training International
soft-sectored
H/Z100
CP/M or Z-DOS
Audience: adult
Running Time: around one hour
Description: ATI Training Power programs are intended to help you learn how to operate particular word processing, data base management, financial planning, or accounting programs.
Features: The ATI Training Power programs simulate the operation of the actual program.

For example, when you use ATI MenuPower Interactive Training for WordStar, the computer shows the same screen display as you would see if you were running WordStar. Then the ATI program "steps" you through some of the elementary functions. At each stage in the tutorial, the program expects you to give one "correct" WordStar command; if that command is given, the ATI program reacts the same way WordStar would. If it's not, the program ignores the input and tells you to try again.

ATI Training Power programs are available for: Lotus 1-2-3, dBASE II, EasyFiler, WordStar, EasyWriter II, Perfect Writer, Spellbinder, Benchmark, Multiplan, SuperCalc, VisiCalc, Perfect Calc, EasyPlanner, Microplan, BPI General Accounting, Peachtree General Ledger, Peachtree Accounts Receivable, Peachtree Accounts Payable, PC-DOS, MS-DOS, CP/M, and BASIC.
Performance: I tried the WordStar training program. It did a good job of simulating the WordStar screen, and it took me through a "no-frills" editing session in about an hour.

One feature which I personally disliked was that the ATI program only responds to the expected instructions at each step through the editing session.

This feature does have the advantage of ensuring that you get into the correct habits. But you lose the opportunity to learn serendipitously through your mistakes. Often, when using a real program, you'll type CTRL-B when you meant to type CTRL-C, and something quite unexpected will happen. Then you'll say "Oh! So *that's* how you do that!"

Furthermore, when you use one of these training programs it's easy to get a "tightrope" attitude about your computer. That is, when you are using a program, you must take this step now (*and no other*), take this step next (*and no other*), and so forth. Naturally, when you come to a spot on the tightrope where you don't know what to do, you *freeze*.

However, these training programs may be the right solution for people who need to train other people to use a

particular program. For some job functions, all the user needs to know is the no-frills way to type in a letter or update a data base.
Ease of Use: The screen presentation is clear and attractively formatted.
Documentation: about 20 pages
Other comments: I also question the cost-effectiveness of these training programs. If you're willing to spend time reading, the information you want is usually somewhere inside the documentation which comes with the program. Of course, the documentation can be obscure and difficult to read. But if you want to supplement the documentation, you might do best to buy an *Introduction to Whatever* book. In crude quantitative terms, you get more words per dollar when you buy a 200-page book for $20 than when you buy a disk for $50 or more.

However, for some people the experience of practicing on a real computer keyboard may be valuable reinforcement in the techniques of using a computer. And running through a disk training program is generally less time-consuming than plowing through obscure documentation or a 200-page book.

Introduction to BASIC Programming
$29.95; The Software Toolworks
hard-sectored
H8&19, H/Z89
HDOS; Extended Benton Harbor BASIC
Audience: adult
Description: This is a course which introduces you to the concepts of BASIC programming.
Features: Each concept is explained with a comprehensive example. Then a programmed question is presented, and you must answer it correctly to continue. After you take each test, the computer reviews it, explaining the questions you answered incorrectly. The final test includes questions from the entire course. There are 29 units of on-screen exercises and five workbook exercises.

In workbook exercise #1, you use the commands PRINT, LIST, and RUN, as well as SCRATCH and OLD, the B.H. BASIC equivalents of Microsoft BASIC's NEW and LOAD.

In workbook exercise #2, you add INPUT, LINE INPUT, and LET to your repertoire.

In workbook exercise #3, you add GOTO and IF...THEN.

In workbook exercise #4, you use a FOR...NEXT loop.

In workbook exercise #5, you use GOSUB to call a subroutine.
Performance: Frankly, I expected this course to be rather superficial. But when I ran through it for the first time, I was quite impressed. The Software Toolworks and Morris Alber, the program's author, seem to have thought very carefully about how to present information to the student.
Ease of Use: The introductory material is cleverly designed to de-fuse some of the problems which the new computer user is likely to encounter. The program shows the user how to answer the computer's questions in a way the computer will recognize. For example, to answer a true/false question, the user must type the entire word "true" or "false", rather than only "t" or "f". Most programs would simply put a message to that effect on the screen, and leave it at that. But this program presents the information, then immediately requires the user to answer a true/false question *in the correct format*.

The program makes extensive use of such reinforcement techniques.
Documentation: 17 pages. A brief glossary is included.

Video Professor
$29.95 each; Husker Systems of Nebraska, Inc.
hard- or soft-sectored
H8&19, H/Z89, H/Z100
CP/M
Audience: adult
Description: The Video Professor series includes "Assembler I," "How to Program in CP/M-85: Structured Programming," and "BASIC I." Each program is available separately.
Features: The lessons covered in "Assembler I" are: "Memory & Numbering Systems," "The CPU and its Registers," "Getting the Feel of Coding," "Origins, Ends, and Compares," "Type a Line—See a Line," "Start a New Program with Sub-routines," "Using the C Flag in our Sub-routines," "Counting and Multiplying Made Easy," "Putting It Altogether in One Bag," and a course summary.

The lessons covered in "How to Program in CP/M-85: Structured Programming" are: "Introducing Program Logic," "Flowcharting and Program Control," "Compound IF," "Nested IF," "Keyboard INPUT," "Control Breaks," "Double Control Break and Report Headings," "Switches and Error Handling," "Updating Files," and "Table Handling."

The lessons covered in "BASIC I" are: "The BASIC Interpreter," "BASIC Command Mode," "Types of Data Storage," "Initial BASIC Instructions," "Input—Decisions," "FOR... NEXT...," "String Manipulation," "PRINT USING," "Disk Files," and "BASIC Program Review."
Performance: The lessons are "meaty"—there are a lot of valuable concepts per screenful of text.

The program quizzes you after each lesson. If you get too many questions wrong, the program will refuse to store your name in the "lesson completed" file.
Ease of Use: The input-handling routines are done pretty well for the most part, but I was able to outfox them once. When the program is giving you a multiple-choice quiz, it's expecting a capital "A", "B", "C", or "D", and will refuse to accept anything else. *Except*, that is, if for some reason you hit SHIFTed-F1, F2, F3, or F4. Those keys send escape sequences to the program—e.g.,ESC1A—but the program ignores the ESC and "1" codes and acts as if you'd just typed the "A". This is certainly a very minor problem, since the chances are very, very low that you would accidentally hit SHIFT-F1, but I hope Husker Systems will fix it in the next version of the program.

A more serious software design problem is that there is no way to exit a quiz other than by CTRL-RESET. This may be intentional, to make sure you finish the quiz, but nevertheless I think it violates the general principle that there should *always* be a safe exit from every level of a program.
Documentation: about 10 pages each
Other comments: The lessons are written in a picturesque and entertaining style. (The author prefaces an explanation of a troublesome feature of BASIC by saying, "Now for the throat grabber!") However, there are some needless stylistic infelicities, grammatical errors ("You did pretty good with only missing two questions"), and misspellings ("it's" for "its"). It is counterproductive to have such errors in any program, and particularly in one intended for educational use.

Geography

States and Capitals
$19.95; CJW Software
hard- or soft-sectored
H8&19, H/Z89, H/Z100
HDOS or CP/M; MBASIC
Audience: children
Running Time: around one-half hour
Description: States and Capitals is an educational game designed to teach state recognition by drawing state maps on an outline of either the eastern or western United States.
Features: The game has been designed so that users can add up to four additional questions to the game by simple changes to a data file.
Performance: The map of the eastern United States is noticeably distorted, particularly around Michigan, Ohio, and Indiana. Indiana and Ohio are too fat and too far over to the east in relation to Michigan (my native state)—so much so that when the program asked me to identify Indiana, I thought it was Ohio.

Perhaps due to the limited resolution of the H/Z19 graphics set, the program can only display one half of the United States at a time (either eastern or western). I think this is an undesirable limitation, considering that most school textbooks and maps present at least the lower 48 states as a whole. Moreover, users of Z100s should be advised that

there are programs such as States Quiz/Demo which use the Z100's graphics capabilities to draw the whole continental United States.

One nice feature: the program lets you choose whether you want to answer questions about state names, state capitals, state flowers, and/or state birds. But if you insert additional questions, they will be presented automatically.
Documentation: 9 pages
Other comments: This is a listable MBASIC program.

States Quiz/Demo
$24.95; Z-Ware (David W. Schade)
soft-sectored
H/Z100
Z-DOS; Z-BASIC
Audience: general
Running Time: around one-half hour
Description: This program uses Z-BASIC's color graphics to draw a high-resolution map of the U.S., then quizzes you on state capitals, etc.
Features: The program also has a continuous "demo" mode, which flashes the correct information about each state on the screen.
Performance: This is the nicest-looking map I've seen on the Z100.
Ease of Use: A minor problem: the program uses the F1, F2, and F3 keys to choose menu options; so when the user is stuck for something to do, it's natural to hit the other function keys. But this can have unfortunate consequences, because States Quiz/Demo doesn't disable the commands Z-BASIC normally assigns to the function keys F4 through F12 (SAVE, PRINT, etc.).
Documentation: three pages
Other comments: This is a non-listable Z-BASIC program.

World-Map
$19.95; Generic Software
hard-sectored
H8&19, H/Z89
HDOS or CP/M; MBASIC
Audience: "4th-grade level or higher"
Running Time: around one-half hour
Description: World-Map uses the H/Z19 graphics set to present a representation of the major continents and oceans of the world.
Features: The computer presents the names and locations of the continents and oceans, then quizzes the student.
Performance: The program opens with some unduly elementary introductory material along the lines of "The earth is round like an orange.... The air is where the birds and planes fly."
Ease of Use: A minor problem: there's a noticeable lag before the program displays the next question on the screen. It's possible to accidentally hit a key which the computer will interpret as an answer to the question it is about to display. So if you're correct, the question will just flash on the screen for a split-second, because the computer is satisfied that you have already given it the answer.
Documentation: one page
Other comments: The distribution disk includes a file of escape sequences called WORLD.MAP, which the MBASIC program WORLD.BAS uses to draw its map on the screen. You can draw the world map with a single command from CP/M: TYPE WORLD.MAP. This is a nice way to demonstrate your computer's graphic and educational capabilities.

Language drills

Hangman
$29.95; SoftShop
hard-sectored
H8&19, H/Z89
HDOS or CP/M
Audience: general
Running Time: around one-half hour
Description: These programs help you build a basic working vocabulary in a foreign language. Each contains over 2,000 words with their common English translations. You can play the traditional word game of hangman, or you may have the computer present words in the flash card manner.
Features: When playing Hangman, an ongoing count is kept of the total number of correct words and the total number of words seen. Also, a display of the percentage of correct guesses is constantly updated so that you can measure your progress. At your option, the English translation can be given as a clue.

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Circle #145 on Reader Service Card

When playing Flashcard, the computer displays a word in either the foreign language or in English (at your option). When you hit the RETURN key, the meaning of the word will be given. An 'Average Time' of your responses is displayed to let you know how fast you are progressing through the words. Also, a running count of the words flashed is kept.

Hangman uses the graphics capabilities of the terminal to do all foreign words, which include accent marks. The program is available in French, Spanish, German, and Italian versions.

Performance: The man in the Hangman's noose is composed of 11 little pieces, so your chances of guessing the word are actually pretty good. Despite the fact that I don't know German, I was able to guess about a third of the words.

Ease of Use: It's only a minor complaint, but it would be nice if the program displayed more explicit advice on how to quit from the Flashcard mode. Pressing "q" gives you the option of leaving the program, but I had to guess that.

Documentation: one page

Other comments: The German vocabulary file is 45K.

LANGDRIL
$15; Hall Design
hard- or soft-sectored; 8" CP/M
H/Z89, H/Z100
CP/M or Z-DOS

Audience: "motivated" adults

Running Time: variable

Description: LANGDRIL is an educational program designed for adults who are studying a foreign language, or who are studying English as a second language. It is "*not* a cutesy little program for children."

Features: LANGDRIL may be used for drilling on vocabulary words.

You enter your own word lists, based on whatever textbook you are using. You can add additional words to your list at any time. You may have more than one list, and you may have several lists for each person who is using the disk.

Once a list has been started, you are drilled on words selected at random from the list. If you miss a word, it is put into a special review list, and you will be drilled on it more frequently. The word will be removed from the review list when you get it right three times in a row.

You may choose to see either the English or the foreign-language word first, and you may reverse this order at any time.

At any time during the drill session, you may pause and see the words on the review list, the number of trials you have had, and the number of right and wrong responses you have made.

At the end of a drill session, you may view the statistics for all your sessions.

Performance: I constructed a fictitious language to test LANGDRIL ("utrop" = "sweater," "gorbash" = "editor," and so forth). After using LANGDRIL a few times, I found that I was indeed mastering the drill pairs I had set up.

Ease of Use: When you type in a word during the LANGDRIL drill session, the program requires that your entry be in uppercase.

I noticed one peculiarity about the program's structure. At the beginning of the program, it asks you to enter your initials and the name of the language you will be using. Then the program lets you choose from a menu of six options. When you're finished with an option from that menu, though, you are returned to the very beginning of the program. So you have to re-enter your initials and the name of your language.

Documentation: 12 pages; there is about a page of tips on methods of language study.

Other comments: H/Z100 users can use an ALTCHARSYS file to reproduce the German, Danish, French, Italian, Spanish, and Swedish character sets. H/Z100 users could also use Software Wizardry's ALTCHR program to create their own specialized character sets.

I'm going to be beginning a foreign language this summer, and I'll probably use LANGDRIL.

Math drill

Mathflash
$15; MMorroware
soft-sectored
H/Z100
Z-DOS; Z-BASIC

Audience: children

Running Time: around one-half hour

Description: Mathflash was designed to emulate the traditional flash card practice used to learn the four basic operations of arithmetic: addition, subtraction, multiplication, and division.

Features: You may choose to do only certain groups or types of questions. For example, you may practice addition, "multiplication by 7", etc. To please children and increase their attention span, Mathflash beeps several times after a correct answer.

Performance: Mathflash poses only single-digit problems, such as 1 x 8 = ?, 4 x 7 = ?, etc.

Ease of Use: If you enter anything other than the correct answer, Mathflash beeps at you once. It would be helpful if the program also flashed a message on the screen—something like "Try again."

Documentation: seven pages

Other comments: This is a non-listable Z-BASIC program.

Math Teacher
$20, discounts for quantity purchases; InterActive Software
soft-sectored
H/Z89

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Circle #131 on Reader Service Card

CP/M
Audience: ages seven years to adult
Running Time: around one half-hour
Description: Math Teacher is designed to reinforce and sharpen arithmetic skills.
Features: You may select addition, subtraction, multiplication, or division problems at a beginner, intermediate, or expert level. You may also select the number of questions the computer will ask, and you may choose whether the computer gives the user one or three tries to answer each question.
Performance: The "expert" multiplication questions are at about the right level of difficulty, e.g., 96 x 13 = ?
Ease of Use: The only way to exit the program is to type CTRL-C or CTRL-RESET. And typing CTRL-C yields an unnecessarily dramatic exit message—"STOP at address 044E"—before returning you to the operating system A> prompt.
Documentation: one page
Other comments: When I got an answer right, the program told me so in what I considered a slightly effusive manner: "Stupendous, Fred." And when I got 100% on a set of questions, the computer insulted me by saying "You must have a computer brain like I do, Fred!" Although the intent to "personalize" the program is worthwhile, educational programs shouldn't perpetuate inaccurate popular stereotypes. Moreover, kids don't always *like* cuteness.

Math Wiz
$19; Studio Computers
hard-sectored
H8&19, H/Z89
HDOS; MBASIC
Audience: elementary and junior high school students
Running Time: around one-half hour
Description: This is a math tutoring program for elementary and junior high school students.
Features: Math Wiz will quiz you on the four basic math functions: addition, subtraction, multiplication, and division. The program will keep track of the number of correct answers given, as well as keeping a percentage score. Math Wiz can pose three types of questions.
Type 1: 123
+45

???
Type 2: 2 + ? = 5
Type 3: 2 + 3 = ?

You may choose which type of problems you'd like to solve; how difficult you would like the problems to be; and how many problems you would like to do.
Performance: You have a wide range of control over the level of difficulty: "1" is the lowest, "20" is the highest.
Ease of Use: The initial menu doesn't provide much "coaching." It would be nice if there were a little more explanatory material.

Also, when you enter the answers to problems, you must use a right-to-left format. That is, to enter the number "168", you'd type "8", then RETURN, then "6", then RETURN, then "1", then RETURN. The advantage of this method is that the computer drill reinforces the procedure the student uses when computing the problem by hand. The disadvantage is that it is confusing and somewhat counter-intuitive when done on a keyboard.
Documentation: four pages
Other comments: The program is rather fragile in that it expects to be on SY0:, and gets confused if you try to run the program from SY1:. This is a common failing of programs written for MBASIC, and can be quite annoying to the user who has a multiple-drive system.

This is a listable MBASIC program.

SuperMath1
$39.95 for HDOS and CP/M versions, $49.95 for Z-DOS; SoftShop
hard- or soft-sectored
H8&19, H/Z89, H/Z100
HDOS, CP/M, or Z-DOS; MBASIC or Z-BASIC
Audience: Grades one through six
Running Time: around one-half hour
Description: SuperMath1 is a computer-aided instruction (CAI) program for mathematics.
Features: Simple addition, subtraction, multiplication, and division; long deci-

WATCHWORD

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Circle #230 on Reader Service Card

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☐ Z-100, ZDOS

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Circle #145 on Reader Service Card

mal addition and subtraction; multiplication and division with long decimals and double-digit divisors and multiplicands; and addition, subtraction, multiplication, and division of fractions. The Z-DOS version can do some other types of problems: carrying and borrowing, lowest common denominator, and reduction of fractions.

SuperMath1 keeps the score and average for each student. Students may compete for positions in the SuperMath1 Hall of Fame.

Parents and teachers may use a password to: set the threshhold score for entering the Hall of Fame; turn off introductory questions; turn on an automatic test mode; determine which types of problems are to be given during a test; print test scores for any of five different classes; or select random test problems.

The Z-BASIC version can use the Z100's color capabilities.

Performance: When you get a correct answer, the program says something encouraging like "Super dooper, trooper!" However, if you offer an incorrect answer, the program says—in white on red—"Wrongo, wrongo, try again." I think "wrongo" is a bit too negative, as well as cutesy.

One of SuperMath1's more valuable features is that it takes you step-by-step through the correct procedures for long division, multiplication and division of fractions, etc. And if you are doing the problem wrong, it does a pretty good job of showing you your mistake.

Ease of Use: You enter the answers to the problems in a right-to-left format. See my remarks under *Ease of Use* for Math Wiz, above.

Documentation: 10 pages

Other comments: SuperMath1 is a non-listable Z-BASIC program. It's unusually large for a BASIC program—55K. SoftShop says "SuperMath1 is the first of an upcoming series of Computer Aided Instruction programs from Toenes Educational Software (TES). ... SuperMath, SuperSpell, and SuperRead programs are being developed to teach the 3 Rs—Reading, Writing, and Arithmetic."

For educators

Elementary Competency Record-Keeping System
$18; $25 with second disk of sample objectives; AdminAid MicroSoftware
hard-sectored
H8&19, H/Z89
HDOS or CP/M; MBASIC
Audience: teachers
Description: This program maintains records telling whether individual students have completed competency objectives.
Features: This program works the same way as the Kindergarten Competency Record-Keeping System, below, except that the objectives are *not* included. The user must use a subprogram to create a file of objectives before using the Record-Keeping System. The user may purchase a second disk which includes a set of essential objectives for grades one through six which were adopted for use in the author's suburban California school district.
Other comments: We were unable to evaluate this program because we didn't receive a review copy. However, the program appears to be quite similar to AdminAid MicroSoftware's Kindergarten Competency Record-Keeping System. (See below.)

GRADING
$12; David Linscott
hard-sectored
H8&19, H/Z89; 56K RAM
HDOS or CP/M; MBASIC
Audience: teachers
Description: GRADING will accept scores for up to 40 students, 16 scores per student.
Features: Several classes may be stored on one disk. Students may be added or deleted at any time. Scores may be corrected at any time.

You may assign weights to each exam, and you may change those weights at any time. All names, scores, averages, and weighted averages may be printed to the CRT or printer. The curve for a particular test or a curve of averages may be printed to the CRT or printer.

Performance: The printout of the grade distribution curves is a particularly nice feature.

Ease of Use: I ran into a few minor difficulties because the program could not store data files on drive D:, the drive from which I preferred to run the program. A message to all Heath/Zenith software designers: please, please, *please* write your programs so they can run from any drive in a multiple-drive system.

Documentation: one page

Other comments: The program looks like a good no-frills solution to the problem of automating grading records. But do you need a computer to maintain grading records? The program automates two procedures which might be prohibitively time-consuming by hand. First, if you decide that you want to change the weights you've assigned to each exam, the computer can do it automatically. Otherwise, you'd have to recalculate each student's overall score by hand. Second, if you want to draw grade distribution curves manually, you'd have to spend a tedious half-hour with graph paper and pencil. GRADING will print the curves for you in about the time it takes you to read this sentence.

This is a listable MBASIC program.

Kindergarten Competency Record-Keeping System
$20; AdminAid MicroSoftware
hard-sectored
H8&19, H/Z89
HDOS or CP/M; MBASIC
Audience: teachers
Description: This program maintains individual student records on completion of 26 listed competencies adopted as the essential objectives in the author's suburban California school district.
Features: You may update the data file, either by student or by objective. You may send to the printer a list of students who have not learned a particular objective. You may also print out a "report card" with a list of the skills required of each student. The system is menu driven and designed for use by more than one teacher.
Ease of Use: I was able to crash the program by giving it incorrect input. While testing, I chose the menu option which allowed me to "update" a student's skills record. Inside that option, the program expects the user to tell it a number from 1 to 27. (There are 26 skills, and 27 is "end update.") Instead of 27, I typed "-1", which is the exit command one level further down within the "update" option. By the principles of good software design, the program should have simply refused to accept that input, and beeped to alert me of my error. However, it didn't do that; after I typed in "-1", it gracelessly booted me out of the program by saying "Illegal function call in 1720", and returned me to MBASIC's "Ok" prompt. Such crashes could be prevented if the program rejected incorrect input.
Documentation: four pages
Other comments: Despite the software design flaws mentioned in *Ease of Use*, this program might be useful to a teacher.

The fact that this is a listable MBASIC program is a point in its favor; you can go in and modify it to suit your particular requirements.

Quizzer
$19.95; Interactive Micro Systems
hard- or soft-sectored
H8&19, H/Z89, H/Z100; 48K RAM
HDOS or CP/M
Audience: general
Description: Quizzer is an educational program designed to administer a series of practice questions to a student.
Features: The questions may be true/false, fill-in-the-blank, or multiple choice. Quizzer is menu driven. Questions may be given sequentially or chosen randomly by the computer.

Questions that are missed may be flagged to be retried later, or they may be asked again immediately until the correct answer is given. The program recognizes more than one correct or incorrect answer to each question. And you may enter different responses for the computer to give to each different answer.

Questions may be selected from the quiz file based on keywords for extra

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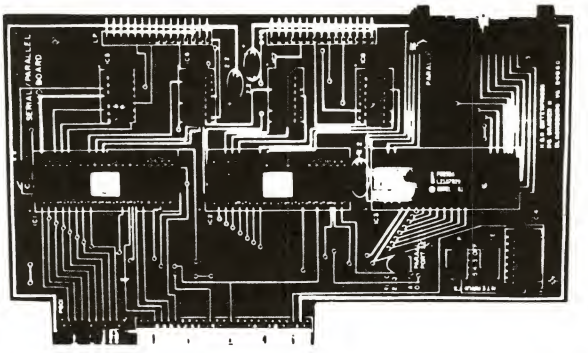

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Disks placed in that drive that are of the specified type can be used as if they were one of the standard disk types accepted by the H8, H/Z89 or H/Z90 computers. Thus PIP, STAT, DIR and others will work for that disk also. The price for MODIFY 89 is $49.95.

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- Cromemco S.S. D.D.
- DEC VT180 S.S. D.D.
- IBM PC/Zenith 100 (CP/M) S.S. D.D.
- IBM PC/Zenith 100 (CP/M) D.S. D.D.*
- Kaypro II S.S. D.D.
- Morrow Micro Decisions S.S. D.D.
- NEC PC-8001A S.S. D.D.
- Osborne S.S. S.D.
- Osborne S.S. D.D.
- Otrona D.S. D.D.*
- Superbrain Jr. S.S. D.D.
- TI Professional S.S. D.D.
- TRS-80 Model I (Omnikron CP/M)
- TRS-80 Model III (MM CP/M)
- Xerox 820 S.S. S.D.
- Xerox 820-II S.S. D.D.
- Standard (Tests for H/Z37 and C.D.R. Disk types)

* = Double sided 5.25" drive required

S.S. = single sided, D.S. = double sided, S.D. = single density, D.D. = double density

Limitations: MODIFY 89 is not a disk duplicate program. It is currently available for use with an H/Z89 or H/Z90 computer that has an FDC-880H double density 8" and 5.25" controller, using C.D.R.'s BIOS V.2.9 or with an H8 computer using the FDC-H8 by C.D.R. Systems, Inc.

MODIFY 100 will soon be released for the Z100 line of computers at a price of $75.00.

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LEARN TO PROGRAM H89/H19 GRAPHICS IN MBASIC

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practice in a special area. You may enter questions into the quiz files using any text editor or word processor.

Quizzer may permit "almost correct" answers, so that it will accept minor misspellings if the response is similar to the correct answer. For example: the response "Georg Washington" may be considered correct as the answer to the question "Who was the first President of the United States?"

Quizzer may be used with a Votrax Type 'N Talk device.

Performance: There is a well-designed menu, which gives you considerable control over your quizzing options.

Ease of Use: I couldn't find any way to quit the program during a quiz, other than CTRL-C or CTRL-RESET.

Documentation: 11 pages

Other comments: When you get answers correct, the program compliments you by saying "Your doing very well." While it is a very common error to confuse "your" and "you're," this is counter-productive in a program which is designed to be used for educational purposes.

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Audience: teachers

Description: ZDS Teacher and its sister program, ZDS Student, make up an educational package which allows instructors to write computer-assisted courses of study for their students.

Features: You have control over the sequence in which the program presents information to the student. However, you can also decide, by using an "index page," to let the student interact with the program and choose a sequence of lessons or units.

You can include quiz and test questions wherever you deem appropriate, and you can include a variety of possible answers to each question.

You can modify a course by using ZDS Teacher's page-management editor, which allows you to copy a page, insert a blank page, and remove the text from a page, or to move a page by using a combination of those functions.

ZDS Teacher provides features that help you to test and correct your course. You can, while you are developing the course, execute it so that you can see it as your students will. If you discover an error as you execute the course, you can enter the "update mode," correct the error, and resume executing the course. You can also print the entire course, or selected pages of the course, so that you have a permanent record in case something should happen to the disk (as well as to your other backup disks).

Performance: I didn't get a chance to run the program. The manual gives you tutorial instructions on how to create a course, but the tutorial looks like a workday's project. Judging by the documentation, the procedure is complicated but not overwhelming. It looks as if setting up a course with ZDS Teacher would take about as many steps as creating a file management system with a program like Condor FMS.

Ease of Use: The program has a basic text-editing facility, which uses a WordStar-style keyboard "diamond" for cursor control (CTRL-D moves the cursor one character to the right, etc.). The arrow keys on the Z100, which are often used for cursor control, do not respond under ZDS Teacher.

Documentation: 22 chapters in a Zenith Data Systems three-ring binder. Glossary. Index.

Other comments: Copyright held by The Answer in Computers of San Diego, California.

ZSS
$350 for CP/M-85 version, $500 for Z-DOS version; Zeducomp
soft-sectored
H/Z100; Winchester hard disk drive or 8" floppy disk drive is recommended for academic institutions with more than 1,500 students.
CP/M-85 or Z-DOS
Audience: school administrators

Running Time: several hours or more

Description: ZSS is a package for scheduling students at academic institutions such as universities, vocational/technical schools, and secondary schools. Its primary function is to assist administrators with the difficult task of matching students' course requests with a master schedule of course offerings.

Features: It is a menu-driven system which includes schedule simulation, conflict analysis, and room-utilization analysis capabilities, as well as scheduling options for flexible study halls, free periods, and meals. The scheduling algorithm is designed to balance the number of students assigned to each section of a particular course.

You create three files which ZSS uses to produce a variety of reports. The files are: course section schedules and seat availability; student names and course requests; and parameter option files, listing the days and times on which classes may be scheduled.

The reports which ZSS creates may be sent to the console or to the printer. They are: course-request tally, course-pair-request tally, course-section schedules, master-schedule conflicts, room occupancy schedules, student schedules, scheduling statistics, and class rosters.

The Z-DOS version of ZSS can send roster files to Lotus 1-2-3, the popular spreadsheet/data base management program, for further manipulation of grading and attendance information.

Performance: I ran through the tutorial which Zeducomp provides with the program. The impression I formed was that ZSS is capable of saving a school administrator considerable time and effort in course scheduling. However, the administrator should not expect that ZSS will make it possible to totally automate the scheduling process. Conflicts may come up, and those must be resolved manually.

Ease of Use: A novice user should probably not attempt to use this program, and users with an intermediate level of experience will probably have to do a bit of wrestling with the documentation. But anyone who feels confident operating a large, complex program—an accounting package, say—should have no difficulty with ZSS.

Documentation: 26 pages in a three-ring binder

Other comments: The documentation is printed in a very small typeface, which I found difficult to read.

Miscellaneous

Chem101
$16.95; Westcomp
soft-sectored
H/Z100; color monitor desirable but not necessary.
Z-DOS; Z-BASIC

Audience: chemistry students and teachers
Description: Chem101 accepts simple molecular formulas up to 18 elements in length (e.g., H2O) and computes the molecular weight, the percentage which each element constitutes of the molecule, the atomic weight for each element in the formula, and the proper atomic number.
Features: Chem101 will print out the above information. It will also draw a three-dimensional color bar graph of the percent of composition of each element that makes up the formula.
Performance: The color graphics are most impressive and entertaining.
Ease of Use: One minor flaw: Chem101 only accepts uppercase letters. Also, the format for entering data is slightly tricky.
Documentation: one page
Other comments: Chem101 is a non-listable Z-BASIC program.

Computer Enhanced Learning
$20; Uneeksoft
hard-sectored
H8&19, H/Z89
HDOS or CP/M
Audience: general
Description: This program asks the user multiple-choice questions and clocks the responses against a timer.
Features: The program is provided with five files of trivia questions on Hollywood, Sports, Current Events, U.S. History, and Places. You may also create your own files of questions; instructions are provided. You may select one of four speeds for the quiz: Very Slow, Slow, Medium, and Fast.
Performance: When you start the program, it asks you how many disk drives your system has. I was honest, and said "4," at which point the program promptly hung up. The next time, I lied, and said "2," and everything worked fine. Perhaps the program is not really asking "how many drives does your system have?" but rather "do you have a one-drive system?" In any event, it should reject input which will make it crash. The documentation warns you of this problem, but it would be better if the problem didn't exist.

Next, the program presents you with a menu of all your quiz files. This is a nice feature, since it saves you the trouble of having to remember the exact file name of the particular quiz you want to take. But if you tell the program to quiz you on a non-existent file, it gets confused. It will ask you a few coherent questions if there's anything remaining in the "question buffer" from a previous quiz, and then the program will start to put gibberish on the screen. The documentation enables you to understand the problem, but again it would be better if the program simply rejected incorrect input.
Ease of Use: Input should be in all capitals, but the program doesn't tell you that.
Documentation: three pages
Other comments: I considered some of the Hollywood trivia questions to be genuinely trivial, e.g., who was the third male lead on "Battlestar Galactica"?

The program was written by Cornelius A. Linebaugh.

Letters and Numbers
$19.95; Intuitive Logic
hard-sectored
H8&19, H/Z89
HDOS and MBASIC 4.82 or higher; or CP/M and MBASIC 5.21
Audience: preschoolers
Description: This is a set of nine MBASIC programs which are intended to introduce preschoolers to the fundamental concepts of numbers and letters.
Features: The programs are designed to communicate concepts such as the relation between a set of three blocks and the number 3; the idea of counting; and the relations between letters and words.
Performance: The program uses the H/Z19 graphics set to do some nice three-dimensional drawings.
Ease of Use: The input-handling routines are good, but the exit command is unconventional. The program tells you at the beginning that you can use SHIFT-* to exit. But if you don't notice the message, or if you forget the exit command, there's no way you can guess it. It would be nice if programmers stuck to conventional exit commands such as "BYE", "EXIT", "QUIT", and CTRL-C.
Documentation: two pages
Other comments: This is a listable MBASIC program.

Management Simulator
$29.95; Dynacomp, Inc.
soft-sectored Z-DOS; 8" CP/M
H/Z89, H/Z100
CP/M or Z-DOS; MBASIC or Z-BASIC
Audience: high school or older
Description: This is a simulation game which models the economic marketplace of the business world.
Features: Each player controls a company manufacturing three products and competing against other companies, each of which sells three similar products. The players attempt to outperform their competitors. The player sets (1) selling prices, (2) labor and material costs per unit, (3) production volumes, (4) marketing expenditures, (5) research and design expenditures, (6) plant purchases or sales, (7) security purchases or sales, and (8) stock dividends. The most successful firm is the one with the highest stock price. The computer may compete as a "pace-setting company."
Performance: The game is a very abstract "number-crunching" approach to simulating the business world, where results are determined by how many dollars you "input" into research and development, marketing, inventory, etc., and by the way you set parameters such as unit cost, price, and so forth. In the world of Management Simulator, the product is literally an abstraction.

This is *an* approach to understanding successful business management, but it is by no means the only approach. I personally think high school students interested in business careers would do better to spend their time improving their reading, writing, and mathematical skills.

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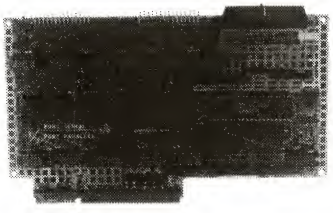

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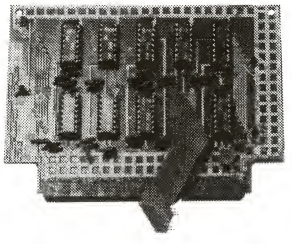

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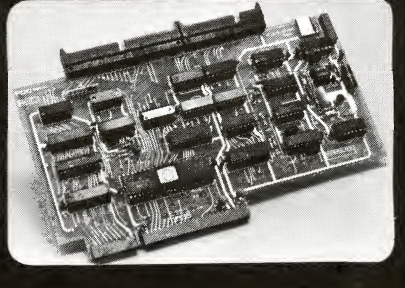

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"number-crunching" approach to business economics, this program might be worth looking into.
Ease of Use: All text is presented in unsightly upper case.
Documentation: 10 pages
Other comments: This is a listable Z-BASIC program.

Management Simulator isn't quite fun enough to be a game, and it's time-consuming, so I'd recommend it only to teachers interested in using it in class.

Preschool Challenge
$24.95; Intuitive Logic
hard-sectored
H8&19, H/Z89
HDOS and MBASIC 4.82 or higher; or CP/M and MBASIC 5.21
Audience: preschoolers
Description: This is a set of eleven MBASIC programs which are intended to introduce preschoolers to the fundamental concepts of numbers and letters.
Documentation: two pages; one page of tips on how your child should use the program, as above.
Other comments: These are listable MBASIC programs.

We were unable to evaluate these programs because our H17 disk drives didn't like the distribution disk we received. But they appear to be quite similar to "Letters and Numbers."

Edward A. Byrnes of Intuitive Logic says he's working on a third disk of "Learning Games" for preschoolers.

Reactor-100
$39.95; Software Wizardry
soft-sectored
H/Z100; version 1.2 or above boot ROM. (You can find out what version your ROM is by typing "V" at the H/Z100's finger prompt.)
Z-DOS
Audience: adult
Running Time: around one-half hour
Description: This is a simulation of the operation of a very simple commercial nuclear power plant.
Features: The simulation is designed to be as realistic as possible. The program gives you information about the status of the reactor, while you control the pumps, turbines, generators, and so forth. Your objective is to produce enough kilowatt-hours to meet the demand, for as long as possible before systems fail. The systems do fail much more frequently than is the case in real life, because it is necessary to make the simulation entertaining as well as realistic.

The program uses the H/Z100's color graphics to draw a high-resolution schematic of the reactor plant.

You may use Software Wizardry's lightpen to select from the command options the program presents you.

There are on-line HELP files.
Performance: The program is similar in many ways to flight-simulator games such as those described in *Sextant* #8's "Games Roundup." The simulated reactor operates faster than a "real time" reactor would, and the user must do a lot of mental calculations very quickly in order to succeed. It's not easy to master this program, but when you do, you will feel a genuine sense of accomplishment.

When the reactor overheats, it melts down in vivid color on the screen of your H/Z100. Unfortunately, creating a meltdown is so entertaining that at least two *Sextant* staffers started to control the reactor with the *objective* of reaching meltdown as quickly as possible.
Ease of Use: The program makes full use of the H/Z100's special function keys.
Documentation: 30 pages. The manual provides several pages of explanation about the design of nuclear power plants, as well as a full reference guide to the functions of each component of the reactor system.
Other comments: The program was written by David B. Wadsworth in compiled Z-BASIC.

Simulators such as this one (and those reviewed in the "Games Roundup" in *Sextant* #8) fall into a grey area between games and educational software. They use simple quantitative models to give you a feel for the operation of some complex technological device such as an aircraft or a nuclear reactor—but the programs are also *fun*.

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Circle #146 on Reader Service Card

Classy Bar Graphs

A Microsoft BASIC program can produce a bar graph from your data, then tailor it to different specifications.

Robert W. Rasch

The most annoying feature of looking at big gobs of data is the first job: making the histogram—the bar graph. Using the programs presented here, though, you can construct histograms, and modify them as necessary to present your data clearly.

Frequently, we tend to take the humble bar graph for granted. We glance at a graph in some company's annual report and see that the receipts or profits are up or down this year. The histogram is merely a convenient shorthand, a "picture" that we look at because we may not feel like reading the report. We feel that if we were *really* interested, we would downplay the bar graph and read the report word for word.

In some cases, however, a histogram is the most effective place to gather and present your data—particularly when you don't know what to expect. Unless you *always* look at a histogram before any other analysis, you may miss significant features in your facts. The shape of a histogram may be lopsided—revealing that the data are skewed in a particular direction. Or it may even tell you that your data consist of more than one population.

Glancing at the histogram in Figure 1 (we will get into details later), we can see that there appear to be two different groups. If, however, we had figured out the average of such a bimodal distribution, we would have arrived at an essentially meaningless number—no member of the group would have a value near its arithmetic mean.

So constructing the histogram should be the first step you take in analyzing statistical data. A bar graph may sometimes look superficial, but it can be a very effective tool if you are willing to use it.

But if you have ever had to construct a bar graph you know that the job can be tedious. It is particularly so with large amounts of data. And there are few of us who, having once constructed a histogram, will recast it to display our data in a slightly different form.

Most of the time, though, such a change can provide a more concise presentation of the same facts.

Ideally, we should be able to recast our histograms in any of three ways. First, we should be able to change the *class interval*: instead of the width of each bar representing one year, for instance, we should be able to change to a quarterly basis. Second, we should be able to change the *class limits*: instead of a year's being from 1 January to 31 December, for instance, we should be able to change the limits so that they are from 1 July to 30 June. And finally, we should be able to change the *vertical scaling*, the height of the bars that represent the *amount* or *number of instances* of whatever we are studying: instead of an inch on the vertical axis representing $100,000 in receipts, for instance, we should be able to change the histogram so that one inch represents $50,000 or $1,000,000.

This last consideration, scaling, will be primarily for convenience, so that our histogram is not unreasonably tall—nor so short that small but significant differences cannot be displayed. Changing the limits and intervals, however, may actually show us relationships that might otherwise not be noticed. For instance, breaking the class interval down to a week might show that all the receipts come in a pattern we had not noticed before.

Working with a histogram by changing the class interval and class limits, however, can be quite a nuisance. Well, such tedious jobs are presumably what we have computers for. The programs presented here are all that you need to construct histograms with style and ease. Listing 1 is a data-entry routine and Listing 2 is VGRAPH.BAS, the program to compute and draw the histogram. They are both in Microsoft BASIC (MBASIC) under the CP/M operating system. Using VGRAPH, the histograms can be recast in any fashion and then printed out, or copied to a disk file, for inclusion in a report. (For greater speed, you may wish to use a compiled version, VGRAPH.COM.)

VGRAPH will automatically scale the histogram's height to fit on the screen of an H/Z89. It will also present the data with the smallest class interval possible—giving you the option to enlarge the interval if you wish. The limits are changed by choosing the beginning value to be referenced on the graph. The program will choose the lowest value in your data file, giving you the option to change it.

VGRAPH has provided me with an easy way to digest large amounts of data with an ease that justifies the purchase of my computer. Every time I need to look at data, I glory in owning an H89.

Using VGRAPH

VGRAPH reads files of single-valued serial data: a series of numbers, no variables or complex expressions. It is probably most convenient to enter the data from a BASIC program. Listing 1 will do the job without any bells and whistles. Any entry errors can be corrected with a text editor. Just keep to the format that BASIC uses: one number after another, each on its own line. There is no need to worry about putting it in any order—VGRAPH will sort it.

VGRAPH.BAS, in Listing 2, is geared entirely to use the graphic capabilities of the '89. To use it, you run VGRAPH from BASIC. It will ask you for the name of the data file and then prompt you from various menus.

In its present form, this program is slow with large amounts of data. However, if you have the BASIC compiler—

Listing 1. A simple BASIC input program to produce a file of serial data, one in which each data value entered is on its own line.

```
10 INPUT"ENTER A FILENAME FOR DATA ";F$
20 ON ERROR GOTO 50' this protects you from erasing data
30 OPEN "i",1,F$
40 PRINT "THAT FILE ALREADY EXISTS!":END
50 OPEN "o",1,F$
60 PRINT"Entering a RETURN with NO DATA ends this program"
70 INPUT"Enter a Data Value ";X$
80 IF LEN(X$)=0 THEN CLOSE#1:END
90 X=VAL(X$)
100 PRINT#1,X
110 GOTO 70
```

BASCOM—you will have all of the speed that you need. The program must first be saved with the "A" (ASCII) option in BASIC. It can be compiled from that form; and you will still have a "human-readable" file to work with if you decide to make any changes later on. I believe you will find that the increase in speed will more than justify the cost of BASCOM.

How VGRAPH works

The operation of the program is simple. It is set up in modules that are called from a central routine in line 250.

The data are read from the disk file into the array D(I), which is dimensioned to hold 1,000 items (line 70). The data manipulations are done in arrays because the program runs faster that way. A subroutine can call the numbers in an array sequentially and perform the same functions on each number in your data set. You can increase the number of items up to the limits of your memory. And you can substitute a variable for the constant, 1,000. (But you cannot use a variable there in the compiled version.) If you regularly work with more than 1,000 items, then change this value to conform to your needs.

The other two arrays in line 70 are BIN and CLASS. These make up the units of the histogram. CLASS holds the values that separate each class; BIN holds the current number of data items within each class.

The program opens the data file, counts the items, then loads them all into the D array (lines 130 through 190). It displays the data (lines 200-210) and then sorts it (subroutine at line 2200). This is followed by a display of the sorted data (lines 2300-2310).

In line 230, VGRAPH determines the size of the classes such that the screen of the '89 will be filled horizontally. It starts the process of setting up provisional class limits and determining the height of the bars so that they fill the screen in a suitable fashion. The initial intervals are established to put all of the data into the histogram with the most narrowly-defined class limits possible. You may want to increase the class intervals from these values when the program offers this opportunity.

The tally routine at line 500 is where time is consumed. You will appreciate BASCOM when you watch the change in the flash rate of the "WORKING" message at this point in the program. This subroutine (line 500) reviews all of the data in the D array and tallies those values which fit into the appropriate BIN array as determined by the values in CLASS. This takes a little time, but doing it by hand takes more—and isn't nearly as much fun as sipping a cup of coffee while the '89 does it all.

The remainder of the program consists of reading the arrays to the screen and changing their contents according to the options provided on the menus. (Remember that displaying a completely new histogram based on the current data is one of the options.) When the program halts on this option list, it is waiting for you to make a choice.

If the histogram is printed to a file, its form will not be that of the screen display. Scaling the height of the histogram for paper is a little different from fitting it on the screen. The file and printer histograms are literal: each "X" represents a value. This may mean a great long sheet of paper if you have 1,000 instances, all in one class! (It is possible to have the H/Z25 printer print the screen just as it appears, but that would take another program. In this regard, you might want to look at Siebert Ickler's "Screen Dump!" article in *Sextant* #9, March-April 1984.)

I should note that VGRAPH is not without a certain fragility. If it were to be aimed at the untrained user, it could be beefed up in places. For instance, the BASIC data-entry program in Listing 1 gives an error message to prevent you from giving your output file the name of

Listing 2. VGRAPH.BAS computes and draws histograms for printer, disk file, or screen display. It is written for Microsoft BASIC running under CP/M, tested under MBASIC version 5.21. As presented here, lines 580, 900, 930, 1090, 2010, and 2500 have been broken for convenience in printing. MBASIC prefers to see one logical line occupying only one physical line. If you wish to break a line, MBASIC lets you use the terminal's line feed key, instead of a carriage return, to move to the next physical line. (This will not work on the 8K version of MBASIC, however.) The ESCape Z command at the end of the program can leave an operator with a blank terminal. An MBASIC LIST command will recover the screen prompt.

```
10 '    PROGRAM NAME `VGRAPH.BAS'
20 ' Author: Robert W. Rasch (c) 1982 version 1.3
30 ' Quillen-Dishner College of Medicine
40 ' Box 19,780A  Johnson City, TN 37614 (615) 928-6425 x235
50 '
60 '
70 DIM BIN(41),CLASS(41),D(1000)
80 PRINT"VGRAPH.BAS VERSION 1.3"
90 PRINT"CAUTION -- DIMENSIONED FOR 1,000 DATA ITEMS ONLY"
100 DEF FNC$(R,C)=CHR$(27)+"Y"+CHR$(31+R)+CHR$(31+C)'cursor
110 TOTAL = 0
120 INPUT"Enter the Filename that has Data ",F$
130 OPEN "i",1,F$
140 IF EOF(1) THEN 180
150 INPUT#1,X
160 S=S+1
170 GOTO 140'counting the house
180 CLOSE#1:OPEN "i",1,F$
190 FOR I=1 TO S:INPUT#1,D(I):NEXT:CLOSE#1
200 PRINT TAB(28)"THE DATA"
210 FOR I=1 TO S:PRINT D(I),:NEXT
220 GOSUB 2200'*== NOW SORT THE DATA==*
230 RANGE=(D(S)-(D(1)))/39
240 FIRST=D(1)
250 REM*==== MAIN PROGRAM BEGINS HERE =======*
260 GOSUB 400'   SET UP THE CLASS LIMITS     *
270 GOSUB 500'   GO TALLY THEM               *
280 GOSUB 2000'  PRINT TABLE OF CLASS LIMITS *
290 GOSUB 700'   PRINT THE DISPLAY           *
300 GOSUB 1000'  SET NEW PARAMETERS          *
310 GOTO 260'    REPEAT MAIN PROGRAM=========*
400 REM*=== SET THE CLASSES UP
410 FOR I=0 TO 40'CLEAN UP THE ARRAYS
420 BIN(I)=0
430 CLASS(I)=0
440 NEXT I
450 FOR I=0 TO 40
460 BIN(I)=FIRST + RANGE*(I-1)
470 NEXT I
480 RETURN
500 REM*==== TALLY IT AND DISPLAY IT ====*
510 PRINT FNC$(1,1)'HOME CURSOR
520 PRINT CHR$(27);"E"'ERASE THE SCREEN
530 PRINT CHR$(27);"x5"'MAKE THE CURSOR DISAPPEAR
540 '*=== NOW TALLY THE CLASSES INTO THE LIMITS =====*
550 FOR I%=1 TO S'GO THROUGH THE DATA FROM SMALLEST TO LARGEST
560 PRINT FNC$(12,40)"WORKING"
570 FOR J%=1 TO 40                                    →
```

```
580 IF D(I%)<=BIN(J%) AND D(I%)>BIN(J%-1)
    THEN CLASS(J%)=CLASS(J%)+1'NOT TOO BIG TALLY IT
590 NEXT
600 PRINT CHR$(27)"E"
610 NEXT I%'GET ANOTHER DATA BIT TO FIT
620 LARGEST=0
630 FOR J=0 TO 40
640 IF CLASS(J)>LARGEST THEN LARGEST =CLASS(J)
650 NEXT J
660 BIN1=BIN(1):BIN40=BIN(40)
670 RETURN
700 REM*===== PRINT OUT DISPLAY =====*
710 PRINT CHR$(27)"E"
715 WIDTH 255
720 PRINT CHR$(27);"F" 'GRAPHICS ON
730 FOR C=20 TO 59
740 L=C-19:K=21-INT(20*CLASS(L)/LARGEST)
750 IF K=22 THEN 770
760 PRINT FNC$(K,1);CLASS(L)
770 FOR R=21 TO K STEP -1
780 PRINT FNC$(R,C);"i";
790 NEXT
800 NEXT
810 LET C=19
820 PRINT CHR$(27);"F"'GRAPHICS ON
830 FOR R=1 TO 22
840 PRINT FNC$(R,C);"t";
850 NEXT R
860 R=22
870 FOR C=19 TO 59
880 PRINT FNC$(R,C);"u";
890 NEXT C
900 PRINT FNC$(23,20)"12345678901234567890
    12345678901234567890";
910 PRINT CHR$(27);"G";'GRAPHICS OFF
915 PRINT"                              (Press any key for menu.)"
920 PRINT CHR$(27);"x1";'ENABLE 25TH LINE
930 PRINT FNC$(25,1):PRINT"class interval ";
    RANGE;"First Class ";BIN(1);
940 PRINT FNC$(1,1)
945 WIDTH 80
950 X$=INPUT$(1)'STOP FOR INPUT OF ANY KEY
960 PRINT CHR$(27);"y1" 'DISABLE 25TH LINE
970 RETURN
1000 REM*=== RESET THE RANGE CLASS SIZES, START ====*
1010 REM*===== TABLE OF PARAMETER OPTIONS ======*
1020 PRINT CHR$(27);"y5"'TURN ON THE CURSOR
1030 PRINT CHR$(27);"y1"'DISABLE THE 25TH LINE
1040 PRINT CHR$(27);"H"'HOME CURSOR
1050 PRINT CHR$(27);"E"'ERASE SCREEN
1060 PRINT TAB(24);D(1);"<==== DATA ===>";D(S)
1070 PRINT TAB(24);BIN1;"<=== GRAPH ===>";BIN40
1080 PRINT TAB(20);"*========= OPTION LIST =========*"
1090 PRINT "1- Change Value of the First Class
     to be Displayed ==>";FIRST
1100 PRINT "2- Change the Class Interval ====> ";RANGE
1110 PRINT "3- Display Another Histogram"
1120 PRINT "4- Exit this Program"
1130 PRINT "5- Print Histogram on the Configured Printer"
1140 PRINT "6- Print Histogram to a File "
1150 PRINT:PRINT
1160 PRINT "Depress Number of the Option of Your Choice"
1170 X$=INPUT$(1)
1180 X=VAL(X$)
1190 IF X<1 OR X>6 THEN 1000
1200 ON X GOTO 1210,1230,1250,1260,2350,2480
1210 INPUT "Enter New Value of First Class Displayed ";FIRST
1220 GOTO 1000
1230 INPUT "Enter the New Class Interval Value ";RANGE
1240 X$=INPUT$(1)
1250 RETURN
1260 PRINT CHR$(27);"z"                                    →
```


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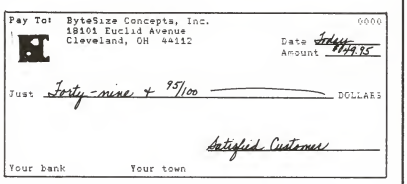

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an already existing file and writing over it. When you file the histogram, VGRAPH will keep you from writing over the data file on which you have based it (line 2500). There is no such protection when you file the frequency table, however. Nor is there any protection for files other than the data file. You might want to expand that protection. And you might want to put in reminders that MBASIC will expect to see file specifications in uppercase characters.

Also, I assumed that only valid data would be input to the program. If you play around with VGRAPH, you will find that a data file with only one entry, for instance, will give the program something of a problem. (However, you may *like* to get the graphics character equivalent of the error message "Divide by zero—Overflow in line 560"!)

These are areas, then, that you might want to look at for future improvements. They will, of course, add to VGRAPH's length. If you feel an error is likely to occur, you might want to add protection. But if you wish, you could even shorten the program a bit.

An example

You need some data to "prove" your program. It can be found in Table 1. This data is the milligrams of glycine per milligram of creatinine in the urine of 37 chimpanzees. (This is taken from S.M. Gartler, I.L. Firschein, and T. Dobzhansky, "Chromatographic Investigation of Urinary Amino-Acids in the Great Apes," *American Journal of Physical Anthropology,* 14:41–57, 1956.)

True, that is probably not an everyday sort of example for most of you. But it was something I had easily available. Moreover, it is the sort of case that shows the value of a computer-driven histogram. We are not out simply to show a picture of figures we already know all about. This is a simple example of an experimental situation where we are trying to *see* relationships that would be difficult to discover otherwise.

The class interval in Figure 1 is .015 milligram of glycine per milligram of creatinine, starting at .008 at the left. Each X in the bar graph's height represents one chimpanzee.

Looking at Figure 1, what if we averaged the numbers on which it is based? It should be evident that an average would not represent the facts at all, because the histogram is not symmetrical. It is rather like average income not meaning much because the distribution of income has a few people with astronomical incomes and many with much lower incomes. The high values distort the meaning of the mean income.

The arithmetic mean of this data is .224. If we look at the histogram produced by these numbers, in Figure 1, we can see that the mean falls in the middle of a large area with no values.

There is an element of bimodality

```
1270 END
2000 REM *=== PRINT THE CLASS LIMIT FREQUENCY TABLE ===*
2010 PRINT"Depress `P' to print the FREQUENCY
     TABLE; `L' to FILE it;"
2015 PRINT"            any other key to display only."
2020 A$=INPUT$(1)
2030 SWITCH%=PEEK(3)
2040 IF A$="L" THEN GOSUB 3000
2050 IF A$="P" THEN POKE 3,SWITCH%+2
2060 PRINT "CLASS LIMIT - frequency <"
2070 FOR I=0 TO 40
2080 PRINT BIN(I);
2090 PRINT TAB(10) "===>";
2100 PRINT USING "######";CLASS(I)
2110 TOTAL=TOTAL + CLASS(I)
2120 NEXT I
2130 POKE 3,SWITCH%
2140 PRINT "Total Number of Items is ";TOTAL
2150 PRINT "Depress any key to continue"
2160 X$=INPUT$(1)
2170 PRINT CHR$(27);"E"
2180 TOTAL=0
2190 RETURN
2200 PRINT"FILE LOADED INTO ARRAY AND ORDERING HAS BEGUN"
2210 PRINT"THERE ARE ";S;" ITEMS IN THE FILE"
2220 PRINT"WHEN COUNTDOWN REACHES ZERO - THE SORT HAS FINISHED"
2230 'BEGINNING OF SHELL-METZNER SORTING ROUTINE
2240 LT=S:CT=LT:BT=LT
2250 CT=INT(CT/2):PRINT CT:IF CT=0 THEN 2300 ELSE DT=1:ET=BT-CT
2260 FT=DT
2270 GT=FT+CT:IF D(FT)<=D(GT) THEN 2290
2280 SWAP D(FT),D(GT):FT=FT-CT:IF FT<1 THEN 2290 ELSE 2270
2290 DT=DT+1:IF DT>ET THEN 2250 ELSE 2260
2300 PRINT"SORT IS FINISHED"
2310 FOR I=1 TO S:PRINT D(I),:NEXT
2320 PRINT"Depress any key to continue "
2330 A$=INPUT$(1)
2340 RETURN
2350 SWITCH%=PEEK(3)'TURNS ON CONFIGURED PRINTER
2360 POKE 3,SWITCH%+2'TURN THE PRINTER ON
2370 FOR L=LARGEST TO 1 STEP-1
2380 FOR C=1 TO 40
2390 IF L>CLASS(C) THEN PRINT" ";
2400 IF L<=CLASS(C) THEN PRINT"X";
2410 NEXT C
2420 PRINT
2430 NEXT L
2440 POKE 3,SWITCH%'TURN THE PRINTER OFF
2450 PRINT"Depress any key to continue"
2460 A$=INPUT$(1)
2470 GOTO 1000
2480 PRINT"enter a filename please "' printing to a file
2490 INPUT F2$
2500 IF F2$=F$ THEN PRINT"THAT'S YOUR DATA FILE, DUMMY!"
     :GOTO 2480
2510 OPEN "O",1,F2$
2520 FOR L=LARGEST TO 1 STEP-1
2530 FOR C=1 TO 40
2540 IF L>CLASS(C) THEN PRINT#1," ";
2550 IF L<=CLASS(C) THEN PRINT#1,"X";
2560 NEXT C
2570 PRINT#1,""
2580 NEXT L
2590 CLOSE#1
2600 GOTO 1000
3000 REM PRINT THE CLASS LIMIT - FREQUENCY TABLE TO A FILE
3010 INPUT"Enter a DATA FILENAME ",F$
3020 OPEN "o",1,F$
3030 FOR I=0 TO 40
3040 PRINT#1, BIN(I),CLASS(I)
3050 NEXT I
3060 CLOSE #1
3070 RETURN
```

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.052	.077	.026	.44	.3
.025	.036	.043	.1	.12
.11	.1	.35	.1	.3
.011	.06	.07	.05	.08
.11	.11	.12	.133	.1
.1	.155	.37	.019	.1
.1	.116			

Table 1. The data represented in Figures 1, 2, and 3. The numbers here stand for the milligrams of glycine per milligram of creatinine in the urine of 37 chimpanzees.

here. There may be more than one population of chimpanzees involved, distinguished perhaps by sex or by genetic difference.

In this example, VGRAPH made the class interval equal to .0010769. With that interval, if you print the histogram to a file it should look like Figure 2. Comparing Figures 1 and 2, you can see that the somewhat wider interval in Figure 1 makes for a histogram that is easier to read, but still preserves the basic features of the data.

Finally, if you wished to, you could change the histogram to an interval *smaller* than the one VGRAPH computed. VGRAPH would truncate the data in order to display the histogram. (See Figure 3.) This would be useful if you wished a more detailed picture of one segment of the histogram. Changing the beginning class displayed would allow you to select the segment you wanted. This would not be useful with the example given here, but could come in handy in displaying considerably larger amounts of data.

These figures, of course, are *not* what the data look like on the screen of the '89! There, it has bells and whistles! The figures are what major computer centers supply you with for histograms. The '89 does much better.

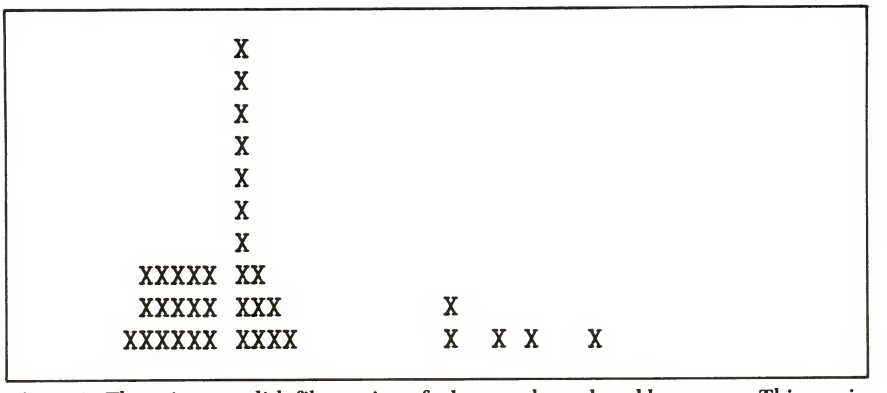

Figure 1. The printer or disk-file version of a bar graph produced by VGRAPH. This one is based on the same data that produced Figures 2 and 3. Each X represents one chimpanzee. (See Table 1.) In this case, we made the class interval somewhat *larger* than in Figure 2. Doing so produced a somewhat denser and more simplified histogram.

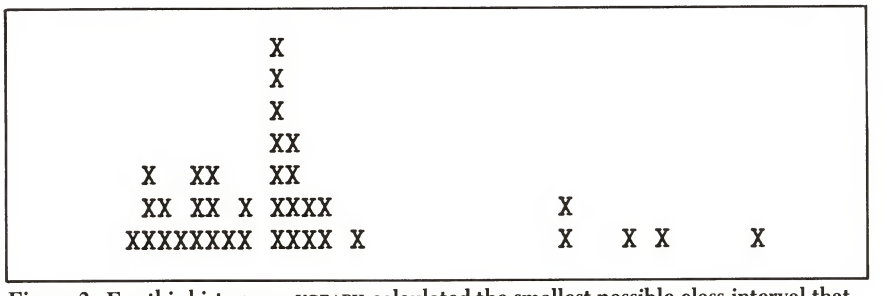

Figure 2. For this histogram, VGRAPH calculated the smallest possible class interval that still allowed screen display of all the data in Table 1. (Changing the class interval produced Figures 1 and 3.)

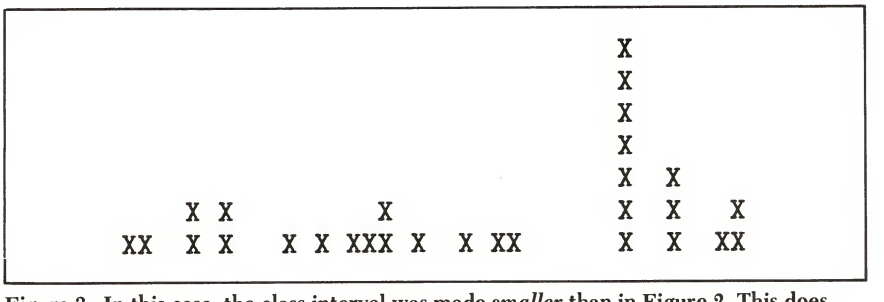

Figure 3. In this case, the class interval was made *smaller* than in Figure 2. This does not allow all the data to be put on the screen. So VGRAPH truncates the display. Here, then, we have the left half of Figures 1 and 2 "stretched out" to fill the width available. Such a process could be useful if you had a large amount of data and wished to examine it more closely, segment by segment.

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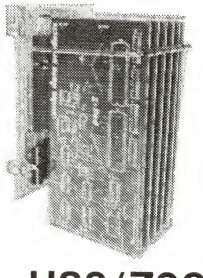

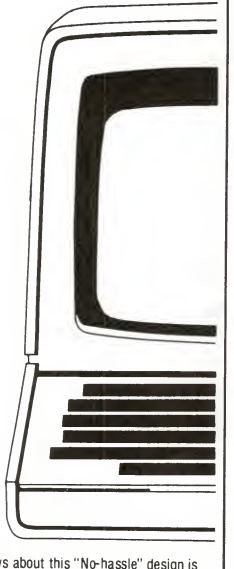

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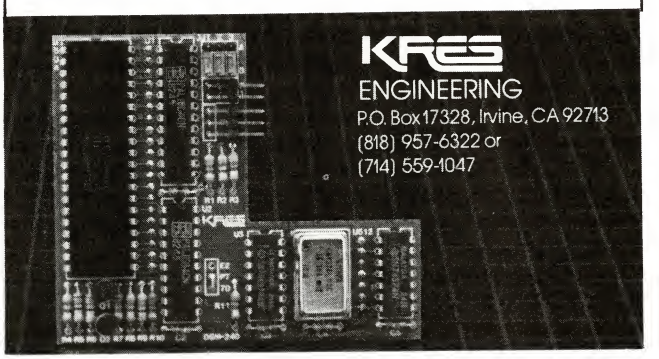

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David Troendle

Graphic representation of data has become one of the most popular methods of presenting microcomputer program output. Too often, however, impressive graphic displays are generated at very unimpressive speeds.

To some extent, this lack of speed may be inevitable. Some displays represent the accumulation of vast amounts of data. Others represent complex relationships that require equally complex calculations be performed by the computer. In either case, we should not be surprised by the lack of speed.

To some extent, however, the lack of speed may not arise out of inherent limitations imposed by the material to be displayed in graphic form. Many times, speed is lost because of how the programmer designed the graphics software. Programmers must select a method of accomplishing their goals, an algorithm, which avoids two chief pitfalls: first, employing processes at which the hardware is relatively slow; and second, containing inefficiencies in the performance of the algorithm itself.

First, the algorithm should avoid processes at which the hardware is relatively slow, relying instead on processes at which it is relatively fast. In the case of the H8 and H/Z89 microcomputers from Heath/Zenith, the primary hardware limitation is right there in the central processor unit. In the H8, this is Intel's 2-megahertz 8080 chip; in the H/Z89, a 2 MHz Z80; both are 8-bit devices. The 8080 and Z80 chips, on their own, can perform only simple integer arithmetic: add, subtract, increment (+1), decrement (–1), and multiply by 2 and its powers (4, 8, 16, etc.). It can divide by powers of 2, but will drop any remainder.

The Z80 and 8080 chips can not, however, multiply (except by powers of 2), divide, or evaluate trigonometric functions. Moreover, they are limited to simple integer arithmetic. They cannot handle real numbers. Therefore, square roots, fractions, and irrational numbers like pi must all be handled in software; only whole numbers can be manipulated by these processors themselves. Any algorithm, then, that involves the use of real numbers, trigonometry, etc., is going to suffer a consequent loss of speed.

And second, aside from these processor considerations, the algorithm itself must be efficient. It should not, for instance, generate redundant dots on a line. Nor should it leave any gaps. And it should utilize any efficiencies or shortcuts offered by the data itself.

The purpose of this article is to aid those who design—or wish to design—graphics software. The specific area of concern is the design of those routines which actually produce the dots on the screen which describe a *straight line* or a *circle*. I will not specifically address ellipses, sine waves, or other forms of curves. However, the concepts discussed here will also have application in designing the routines for many other curves.

The routines presented here never waste time generating a redundant dot, never skip a dot on the curve, and use only integer addition and subtraction.

The routines presented here never waste time generating a redundant dot, never skip a dot on the curve, and use only integer addition and subtraction. (No trig, multiplication, division, table look-ups, nor any real arithmetic is used.) So they are fast.

The only algebra required to understand the algorithm discussed here is at the college-freshman level. The line- and circle-drawing routines presented here are given in Pascal to make it easier to follow the methodology, algorithm, and structure. Thus some familiarity with Pascal will be helpful in following the routines.

Since a well coded assembly-language routine is usually at least three times faster than that same routine coded in a high-level language, the target language for these routines should be assembler language. They were originally written in assembler language for the H8 (2 MHz 8080) using the HA-8-3 color graphics board to display the dots on the screen. (The HA-8-3 uses the Texas Instruments TMS-9918A as the video controller.)

The line-drawing routine required only 8-bit arithmetic and produced dots at a rate of approximately 4,500 dots per second. The circle-drawing routine required 16-bit arithmetic and consequently ran somewhat slowly by comparison.

As with most hobbyist-grade systems, the graphics boards used with the H8 and the H/Z89 are capable of displaying at least 192 lines with 256 dots on each line. Since such displays are so common, the routines presented below will assume this configuration.

Which routines are important?

There are three levels of problems involved in designing a graphics package.

The first level, the "high level" of design problems, is concerned with assimilating the information presented by the user into the graphics package. This is the level at which the user communicates with the graphics system.

At the high level, the solutions to design problems are varied. They depend heavily on the nature of the data to be represented graphically. In some cases, all the data can be expressed in a mathematical formula or formulas, whether the formulas are simple or complex. In this case, the user only enters the specific values of the formula's parameters.

Other data—financial data, for instance—is basically an accumulation of discrete events. And in still other cases, the user wishes to alternate between these two kinds of data.

One approach to graphic representation at the high level is to use subroutine calls (such as the standard

CalComp routines). Another form of subroutine calling is to provide the user with graphics commands in a programming language (such as Z-BASIC for the Z100).

Or one can use user-input control-command punched cards and data. An example of this is the SAS/GRAPH package (statistical analysis system/graphics). This has the ability to accept a mass of data, as from a financial table, and figure out how to display it.

These various methods are all widely used. Which method is "the best" depends on individual preference and the nature of the data to be displayed.

In this article, we are going to be concerned with representing data that can be expressed in a formula.

The second set of design problems deals with determining which dots on the graphic display have to be turned on due to a user request at the first level. It is these intermediate-level design problems that this article addresses.

The third level of design problems is usually considered the device-driver level. This level concerns itself with actually turning on a dot which the intermediate level routines have determined must be on. These lowest-level routines are device dependent.

How high and intermediate levels fit together

First, we need an understanding of where the intermediate-level routines fit into the overall structure of a graphics package. Since lines and circles describe relationships between pairs of real numbers, the highest-level routines in a graphics package should interface to the application code using real numbers.

For example, a high-level routine to draw a line from (X_1,Y_1) to (X_2,Y_2) might have the following Pascal invocation (call):

```
LINE (X1,Y1,X2,Y2);
```

The high-level routine to draw a circle of radius R centered at (X,Y) might have the following Pascal invocation:

```
CIRCLE (X,Y,R);
```

The high-level routine would accept those real-valued Cartesian coordinates passed as parameters. It would then translate them to the closest corresponding discrete dot coordinates of the *picture elements* (the pixel addresses). The high-level routine would then call an intermediate-level routine. Starting from the initial dot coordinates provided by the high-level routines, the intermediate-level routine would be responsible for computing the rest of the dot coordinates, those that best match the desired curve (including straight lines).

For each dot coordinate computed, the intermediate-level routine would call a low-level routine. The low-level routine turns on (or turns off, or possibly toggles) the dot at the computed coordinate.

The high- and low-level routines present very few design or implementation problems. However, the intermediate-level routine can get quite complicated—especially if speed is a design goal. In order to better understand the design of the intermediate-level routines, a sample set of high-level routines will be presented. This will illustrate the interface to the intermediate-level routines.

The role of the high-level routine

Our high-level routines must be able to take the beginning Cartesian coordinates and translate them to dot coordinates. To aid the high-level routines in doing this, the functions below will be used.

These functions assume that variables XMIN (the minimum X value), XMAX (the maximum X value), YMIN (the minimum Y value), and YMAX (the maximum Y value) are all globally defined real variables. These variables are assumed to have been given values at the beginning of the higher-level routines, i.e., initialized with valid values. Note that these functions assume a 192 x 256 screen, as mentioned above. (A more fully implemented graphics package would normally also include range checking.)

```
function XORD (X:real):integer;
begin
  XORD:=round(((X-XMIN)*255.0)/(XMAX-XMIN))
end;

function YORD (Y:real):integer;
begin
  YORD:=round(((Y-YMIN)*191.0)/(YMAX-YMIN))
end;
```

For those readers who wish to verify these routines, note that:

1) XORD(XMIN) = 0, the leftmost dot on a row of dots.
2) XORD(XMAX) = 255, the rightmost dot on a row of dots.
3) YORD(YMIN) = 0, the bottommost dot in a column of dots.
4) YORD(YMAX) = 191, the topmost dot in a column of dots.

While the above is by no means a proof, it does at least show that the translations produce reasonable results at the boundaries.

Putting them together

These translation routines induce the following design considerations on the intermediate-level routines: the bottom-left dot on the display is called (0,0); and the top-right dot is called (255,191). (If this orientation is not correct, the low-level routine can compensate with a final translation.) This orientation implies that the aspect ratio of the display is 256:192. Therefore the ratio of (XMAX-XMIN):(YMAX-YMIN) must also be 256:192. If the ratio of (XMAX-XMIN):(YMAX-YMIN) does not equal the display's aspect ratio, then circles will appear as ovals, and lines will not appear to have the correct slope.

Now that the translation routines are defined, the high-level routines for a line and circle become quite simple. In the following high-level routine, the intermediate-level line-drawing routine called by it is named LINE2. LINE2's purpose is to compute the coordinates of all the dots which best approximate a straight line between (IX1,IY1) and (IX2,IY2).

```
procedure LINE (X1,Y1,X2,Y2:real);
var
  IX1,IX2,IY1,IY2:integer;
begin
  IX1  := XORD(X1);
  IX2  := XORD(X2);
  IY1  := YORD(Y1);
  IY2  := YORD(Y2);
  LINE2(IX1,IY1,IX2,IY2)
end;
```

In the following high-level routine, the intermediate-level circle-drawing routine called by it is named CIRCLE2.

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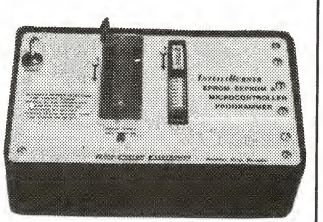

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CIRCLE2's purpose is to compute the coordinates of all the dots which best approximate a circle centered at (IX,IY) and having radius IR.

```
procedure CIRCLE (X,Y,R:real);
var
  IR,IX,IY:integer;
begin
  IX  := XORD(X);
  IY  := YORD(Y);
  R   := XORD(R); {R is in X-axis units}
      CIRCLE2(IX,IY,IR)
end;
```

Goals of intermediate-level routines

Now that the high-level routines have been defined, the design of the intermediate-level routines can begin. Simply stated, the design goals of the intermediate-level routines are speed and accuracy. Therefore, there are a number of factors which should weigh heavily in the design decisions.

As mentioned above, some of these factors arise out of constraints imposed by the chip:

1) Don't multiply unless absolutely necessary. If multiplication is necessary, constrain it preferably to multiplication by powers of two, or at least to occurring outside of loops.
2) Don't divide (unless by powers of two).
3) Don't perform trigonometric operations.
4) Use integer or rational arithmetic instead of real arithmetic.

Other factors will be dictated simply by the desire for speed and accuracy, irrespective of the hardware:

1) Choose an algorithm which does not waste time generating redundant dot coordinates.
2) Avoid choosing an algorithm which may skip dot coordinates on the curve. Choosing an algorithm which can skip dot coordinates—especially if it skips with a regular pattern—produces a poor-quality curve.
3) Make use of any curve symmetries to speed up dot generation. Reflection about a symmetric axis is usually faster than other computational methods. For instance, the intermediate-level circle-drawing routine computes only the dots between 0 and 45 degrees and generates seven reflections for each dot to complete the remaining segments of the circle. Sometimes a simple axis translation will aid in making use of symmetry.
4) Attempt to develop your algorithm within the discrete dot coordinate system. Using the real Cartesian coordinate system entails real arithmetic followed by a conversion to the discrete dot coordinate system. This will be slow.

ΔX and ΔY: what changes are occurring

While the algorithms for circle and line drawing are very different, they share a significant amount of developmental methodology. In fact, the same developmental techniques can be used for many curves. Before discussing the algorithms for intermediate-level circle- and line-drawing routines, let us begin to explore the methodology used.

One of the design considerations is to prevent redundant dots. Therefore, whenever the algorithm generates the next dot on the screen, there must be some change on either the X-axis (horizontal axis) or the Y-axis (vertical axis)—or possibly both—from the position held by the preceding dot.

The relationship between the absolute value of the change on the X-axis ($|\Delta X|$) and the absolute value of the change on the Y-axis ($|\Delta Y|$) is crucial to the methodology presented here. Basically, every time we move from one dot to the next, at least one of the ordinates must change. Logically, the only alternatives are that the change in one must be equal to or greater than the change in the other.

This relationship can be concisely stated as follows:

1) $|\Delta X| >= |\Delta Y|$, or
2) $|\Delta Y| > |\Delta X|$

This relationship is going to tell us which ordinate must always be incremented.

To develop this idea, *we can think of the curve as a point in motion.* X and Y are the continually changing values which describe that moving point. The relationships above mean that either the X value changes as fast as or faster than the Y value, or the Y value changes faster than the X value. For most commonly encountered curves, one of the two above relationships will hold true over a *segment* of dots on the curve—rather than just at an isolated point.

For instance, on a straight line, one and only one of the relations will hold for every point on the line because the slope of the line ($\Delta Y/\Delta X$) is constant. (See Figure 1.) If the line is shallower than a 45-degree diagonal, then the X values are changing faster than the Y values. If X is increased by an amount, Y will change by less than that amount. (See Figure 1a.) On the true diagonal line, the X and Y values are changing at the same rate. If X changes by an amount, Y will change by less than that amount. (See Figure 1b.) And for lines steeper than the diagonal, the Y values change faster than the X values. (See Figure 1c.)

While one of the above relations will hold for all points on a straight line, one of the two relations will hold only for a part of most curves. As an example, consider the points from 0 to 45 degrees on a circle. (See Figure 2.)

On this arc, the Y values change faster than the X values (i.e., the magnitude of the slope is greater than 1). But on the arc from 45 to 90 degrees, the X values change faster than the Y values.

To better understand this, consider the circle as a sequence of very small line segments. The line segments close

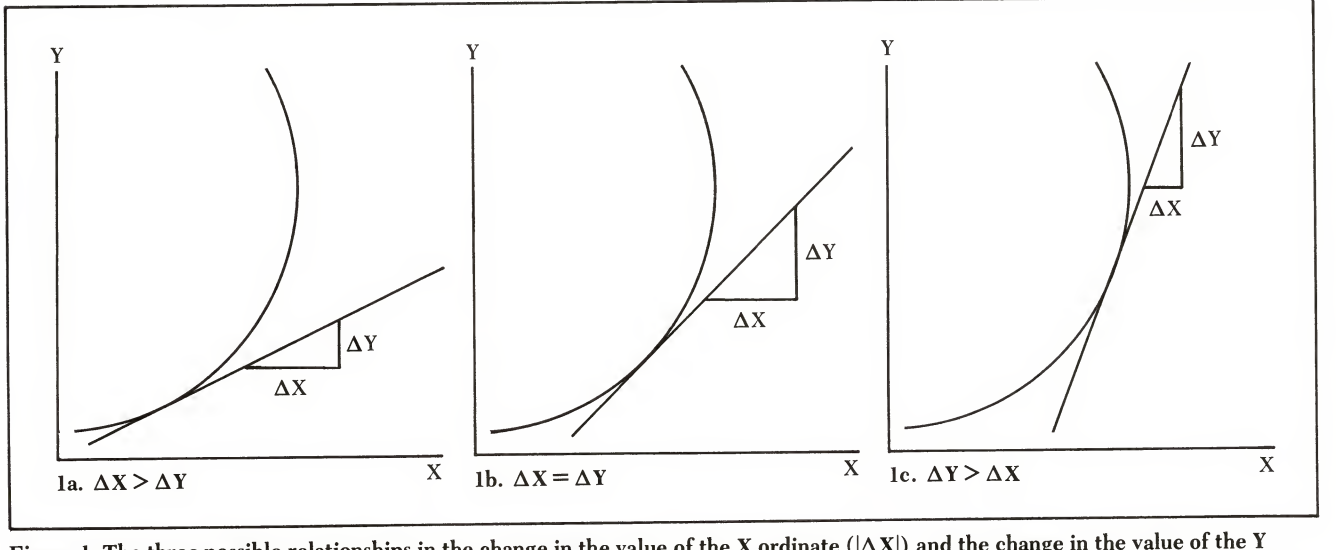

Figure 1. The three possible relationships in the change in the value of the X ordinate ($|\Delta X|$) and the change in the value of the Y ordinate ($|\Delta Y|$). (In these figures, we can treat short segments of a circle as if they were straight lines.) Figure 1a is for angles less than 45 degrees; Figure 1b is for a 45 degree angle. These two cases together constitute relation 1, $|\Delta X| >= |\Delta Y|$. (See text.) Lines greater than 45 degrees are described by relation 2 ($|\Delta Y| > |\Delta X|$).

to 0 degrees are very steep. For these line segments, the change in Y is much greater than the change in X. Continuing around the circle toward 45 degrees, the line segments become less and less steep. For these line segments, the change in Y is only slightly greater than the change in X. The line segments close to 45 degrees are essentially diagonal lines. Hence the change in Y is very close to the change in X. As the line segments pass 45 degrees, the X values start to change faster than the Y values. From 45 to 90 degrees the line segments become more and more shallow, indicating that the changes in X values are becoming greater and greater than the changes in Y values.

At this point, it should be clear that one of the two relations will hold for any segment of a curve. But how can these relations help in the generation of dots on a curve?

The answer, as shown below, is that the relations can be used to generate points on a curve which are not redundant and further are guaranteed not to skip any dots. This satisfies two very important design considerations. Let us now explore some of the implications of these two relations.

No redundant dots, none skipped

Assume for the moment that relation 1 ($|\Delta X| >= |\Delta Y|$) holds for a segment of a curve on which we wish to generate the next dot which is non-redundant and which also does not skip any point.

When relation 1 holds, the algorithm dictates that we will always change X by one. (The Y value may or may not change by one, as we will see later.) In the dot-coordinate system, the minimal change in X is either one dot to the left (subtract 1) or one dot to the right (add 1). Obviously, no holes will be left on the X axis by moving one position left or right. Further, since we always change X, the new point cannot be redundant.

When the next point is generated by changing X, the Y value may also change. This could cause a hole on the Y axis if Y were to change too fast (by more than one). But since relation 1 holds, it guarantees that the change in Y will not exceed the change in X. Since X is always changed by one when relation 1 holds, this guarantees that the change in Y will not exceed one (which is the change in X). Therefore, no hole will be left on the Y axis.

Now let us consider what happens when relation 2 holds for a segment of a curve. When relation 2 holds, we will always change Y by one. (We may or may not change the X value by one, as we will see later.)

The same constraints apply as before (i.e., no redundant points and no skipped points). In the dot-coordinate system, the minimal change in Y is either one dot up (add 1) or one dot down (subtract 1). Obviously, no holes will be left on the Y axis by moving one position up or down. Further, since Y always changes, the new point cannot be redundant. When the next point is generated, the X value may also change. This could cause a hole on the X axis if X were to change too fast (by more than one). But since relation 2 holds, it guarantees that the change in X will not exceed the change in Y, which is always one. Therefore this guarantees that the change in X will not exceed one and no holes will be left on the X axis.

Thus we have achieved our goal of avoiding redundant dots while at the same time ensuring that no dots will be skipped. So far, based on the relationship of the change in X to the change in Y, the design guarantees that we will always change either the X or Y ordinate by one; we may or may not change the other ordinate.

(This relationship is critical to the algorithm presented here. Sometimes, though, there may be some confusion in referring to "the ordinate we will always change," and "the ordinate we may or may not change." A simpler way to think of them may be as the "faster" ordinate and the "slower" ordinate. These speed terms are not always correct, however, since the ordinates will sometimes be increasing or decreasing at the same speed—as happens at 45 degrees. I will use these speed terms for convenience, though, as well as their lengthier counterparts.)

There are now two problems which must be addressed. One is how to make the decision of whether or not to change the "ordinate which we may or may not change," the "slower" ordinate. The other problem is to detect if the new dot generated has changed the relationship of the change in X with the change in Y.

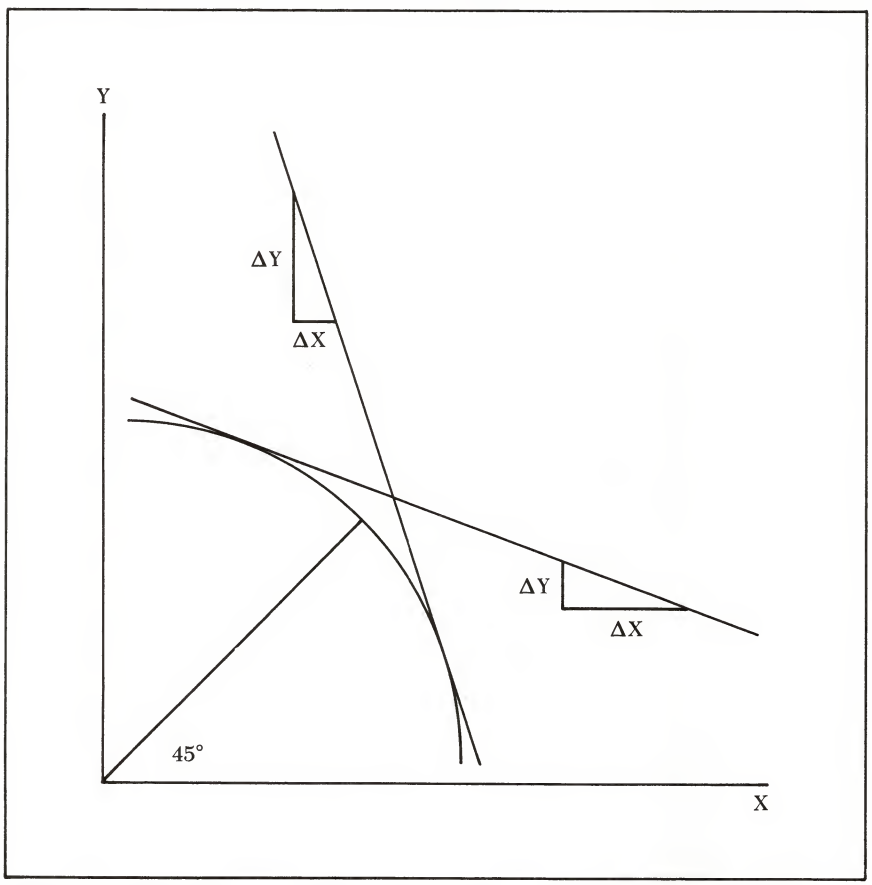

Figure 2. Another illustration of the relationship between ΔX and ΔY before and after 45 degrees.

Tracking deviation

So, we have a faster ordinate (X or Y, depending on which relation holds) that we are always going to change in generating a new dot. We may or may not change the other, the slower, ordinate. Let us now examine how to make the decision as to whether or not to change the slower ordinate.

It is at this point that most algorithms lose their speed by attempting to evaluate the function which describes the curve. Such algorithms lose speed since the curve is usually represented by mathematics outside the instruction set native to the central processor chip. Even if they do not evaluate the function, they at least evaluate some approximation of that function. (The approximations usually involve some form of table look-up—which can also be a time-consuming activity.)

There is an alternative to evaluating the function. It is mathematically equivalent to doing so; but as it turns out, it will be a lot faster. This alternative is to keep track of the *deviation* of the dot coordinate from the ideal function. Once this decision is made, then we have simplified the problem of whether

or not we will change the slower ordinate:

If changing the slower ordinate by one yields a deviation closer to zero than not changing it, then change the ordinate.

Let us now consider an example of this process.

Suppose we have just plotted a dot on the arc of a circle from 0 up to 45 degrees, and wish to compute the next dot on that arc. Since $|\Delta Y| > |\Delta X|$ for all points on that arc, the algorithm states that Y will always be changed by one and X may or may not change.

On the arc under consideration, when Y changes, it changes in the positive direction (up). Therefore the next dot will have its Y ordinate increased by 1. How does increasing Y by one affect the deviation from the ideal arc? The answer to this question will require some simple algebra. The values (X,Y) which satisfy the following equation will lie on a circle of radius R centered at the origin:
$X^2 + Y^2 = R^2$

In the dot-coordinate system, very few integer values will exactly satisfy the above equation. The following function will measure the deviation of a given (X,Y) from the ideal function:
$f(X,Y) = X^2 + Y^2 - R^2$
Note: when $f(X,Y)=0$ (or no deviation) $X^2 + Y^2 = R^2$.

And the change in deviation caused by incrementing Y will be given by:
$f(X,Y+1) - f(X,Y)$

In other terms, the above formula is

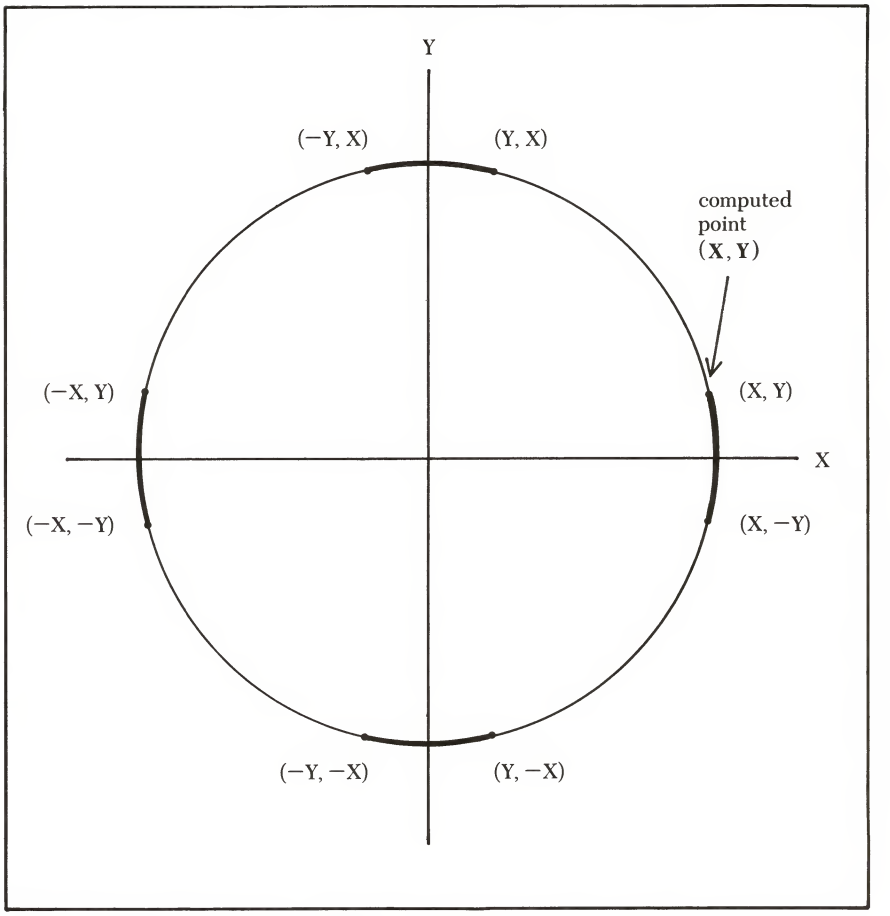

Figure 3. Points which will be reflected on a circle. In this example, we can compute a point (X,Y), knowing it will be reflected by seven others. We are therefore spared the necessity of computing those other points.

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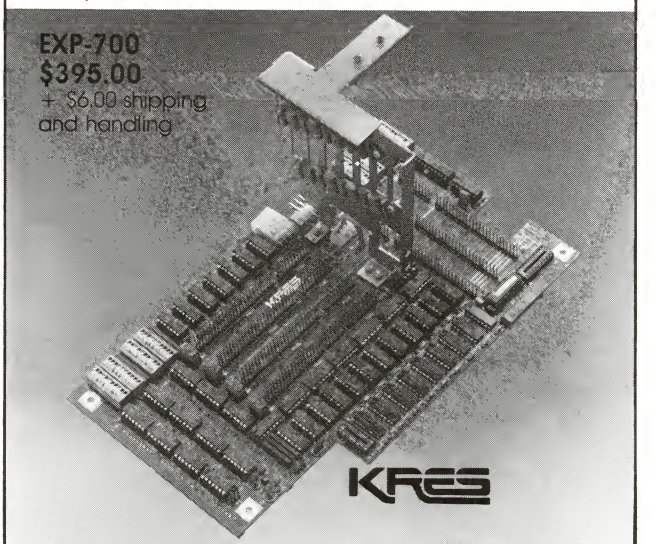

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the deviation with Y incremented less the deviation with Y not incremented. Reducing the above formula yields the change in deviation caused by incrementing Y. Let us now reduce the above formula:

$f(X,Y+1) - f(X,Y)$
$= X^2 + (Y+1)^2 - R^2 - [X^2 + Y^2 - R^2]$
$= X^2 + Y^2 + 2Y + 1 - R^2 - X^2 - Y^2 + R^2$
$= 2Y + 1$

Simply stated, the formula above means that if Y is increased by 1 then the deviation from the ideal curve is increased by 2Y+1. So, while the formula for a circle is rather complicated, the change caused by incrementing Y by 1 is quite simple.

Since the algorithm requires Y to be incremented, the deviation is increased by 2Y+1.

Changing the "slower" ordinate

Now to decide whether or not to change X after having incremented Y.

All changes in X are negative on the arc between 0 and 45 degrees. Therefore, if X changes, it will decrease by 1. How does decreasing X by 1 affect the deviation from the ideal curve? The change in deviation caused by decreasing X by 1 is given by the formula:

$f(X-1,Y) - f(X,Y)$
$= (X-1)^2 + Y^2 - R^2 - [X^2 + Y^2 - R^2]$
$= X^2 - 2X + 1 + Y^2 - R^2 - X^2 - Y^2 + R^2$
$= -2X + 1$

Therefore if X is decreased by 1, then the deviation is changed by $-2X+1$.

The decision to decrease X by 1 can be made as follows: if adding $-2X+1$ to the deviation yields a deviation closer to 0 than not adding $-2X+1$, then decrease X by 1.

The reasons for choosing to keep track of the deviations rather than attempting to evaluate the function should be clearer now. When only one variable of a function is changed by at most 1, even very complicated functions yield much simpler expressions for the change in deviation. Since the deviation is minimized (i.e., kept close to 0), only single-precision integer arithmetic is required to track the deviations.

```
procedure CIRCLE2 (IX,IY,IR:integer);
var
  X,Y,DEV:integer;
procedure REFLECT;
begin {REFLECT}
  PLOT (IX+X,IY+Y);
  PLOT (IX-X,IY+Y);
  PLOT (IX+X,IY-Y);
  PLOT (IX-X,IY-Y);
  if X <> Y
    then {do not generate redundant reflections}
      begin
        PLOT (IX+Y,IY+X);
        PLOT (IX-Y,IY+X);
        PLOT (IX+Y,IY-X);
        PLOT (IX-Y,IY-X)
      end
end {REFLECT};
begin {CIRCLE2}
  X := IR;
  Y := 0;
  DEV := 0;     {initial deviation is 0)
  PLOT (IX+IR,IY);
  PLOT (IX,IY+IR);
  PLOT (IX-IR,IY);
  PLOT (IX,IY-IR);
  while Y < X   {on arc from 0 to 45 degrees}
    do
      begin
        DEV := DEV + Y + Y + 1; {change deviation due to Y}
        Y := Y + 1;             {Y is always incremented}
        if DEV > X
          then  {decrementing X will reduce deviation}
            begin
              DEV := DEV - X - X + 1;   {reduce deviation}
              X := X - 1
            end;
        REFLECT
      end {while}
end {CIRCLE2};
```

Listing 1. An intermediate-level circle-drawing routine. It is presented in Pascal to emphasize the algorithm. To improve the performance, it should be coded in assembly language.

Obtaining the deviation formula

It is time to discuss how to obtain the deviation formula. The most important characteristic of the deviation formula is that changing an equation variable by one produces only integer changes in deviation. To start this process, we need to obtain a curve-defining equation which can be written with only integer coefficients and constants and which has functions which yield only integer results.

For instance, using the following equation to define a circle would yield a disastrous deviation equation:

$R = \sqrt{(X^2 + Y^2)}$.

The results of the square root are not necessarily rational, much less integers.

However, squaring both sides removes the offending square root.

Once the curve-defining equation has only integer coefficients and constants, and the only functions invoked yield integer results, re-arrange the equation so that one side of the equation is 0. The re-arranged equation is the deviation formula. It should have the property that integer changes in the equation variable produce only integer changes in deviation.

Since the algorithm calls for tracking deviations, we do not need the actual deviation. We can work with the formula for the change in deviation. This deviation formula is nothing more than the difference of the deviation function evaluated first with one of its variables changed, and then with no variables changed. Note that different changes in deviation formulas will be obtained depending on which deviation-function variables are changed and how (incremented or decremented).

A straightforward example of this process is the development of the deviation formulas for circles, above. A more complicated example of this process will be given when the line-drawing routine is presented later.

Given that the change in deviation formulas can be obtained, deviations can be tracked—provided that we know the initial deviation of the first dot produced. For lines and circles, this is always 0.

This routine can also evaluate the deviation function for a function whose initial deviation cannot be easily determined. Of course, this may be slow. But fortunately this is an initialization characteristic; and once the initial deviation is known, the deviations can be tracked from there.

Detecting changes in the relationship of $|\Delta X|$ with $|\Delta Y|$

As we saw earlier, the relationship of $|\Delta X|$ with $|\Delta Y|$ determines which ordinate is always incremented. In drawing a straight line, the relationship remains fixed. And in the circle-drawing algo-

rithms presented below, we will be dealing with portions of the arc in which it remains fixed. So in the line- and circle-drawing algorithms presented below, detection of a change in this relationship will not be required.

For other curves, this may not be the case. So, as each dot is generated, the algorithm must be able to detect changes in this important relationship. The methodology employed here has built-in features for detecting such changes. We need not compare the change in X with the change in Y. Instead, the change in deviation caused by changing X can be compared with the change in deviation caused by changing Y. Suffice it to say, this should be true for most reasonable deviation functions. It will work, for instance, with the polynomial approximation of a sine wave.

(But what about more complex situations? In such cases, the mathematics required can become considerably more sophisticated. For those who are interested in pursuing the matter further, some knowledge of real analysis is needed to determine if changes in deviation can be used in lieu of changes in either X or Y. This will work if a "measure" can be obtained on the deviation formula.)

The circle-drawing algorithm

At this point, the intermediate-level circle-drawing routine can be presented. Let us now recall how the high-level routine calls the intermediate-level routine

CIRCLE2 (IX,IY,IR);

where (IX,IY) is the dot coordinate of the center of the circle, and IR is the radius of the circle. All three parameters are integers.

In order to make use of the symmetries of a circle, a circle of radius IR centered at (0,0) will be generated and then translated to a center of (IX,IY) by adding IX to the X ordinate and IY to the Y ordinate of each dot generated.

Consider now the symmetry of a circle centered at (0,0), as shown in Figure 3. If (X,Y) is a dot on the circle, then so are the following reflected points: (–X,Y), (X,–Y), (–X,–Y), (Y,X), (–Y,X), (Y,–X), and (–Y,–X). Except for when Y=X or either X or Y is 0, the above reflections are not redundant. When Y=X, the last four reflections are redundant.

After examining the symmetries of a circle, it should be clear that only the dots from 0 to 45 degrees need to be generated. The rest of the dots on the circle are reflections of these dots.

Dots from 0 up to 45 degrees imply $|\Delta Y| > |\Delta X|$ (relation 2). Also, from 0 up to 45 degrees, Y is increasing and X is decreasing. Therefore for each dot generated, Y always increases by 1, and X may or may not decrease by 1 (depending on whether changing X reduces the deviation). For each dot gen-

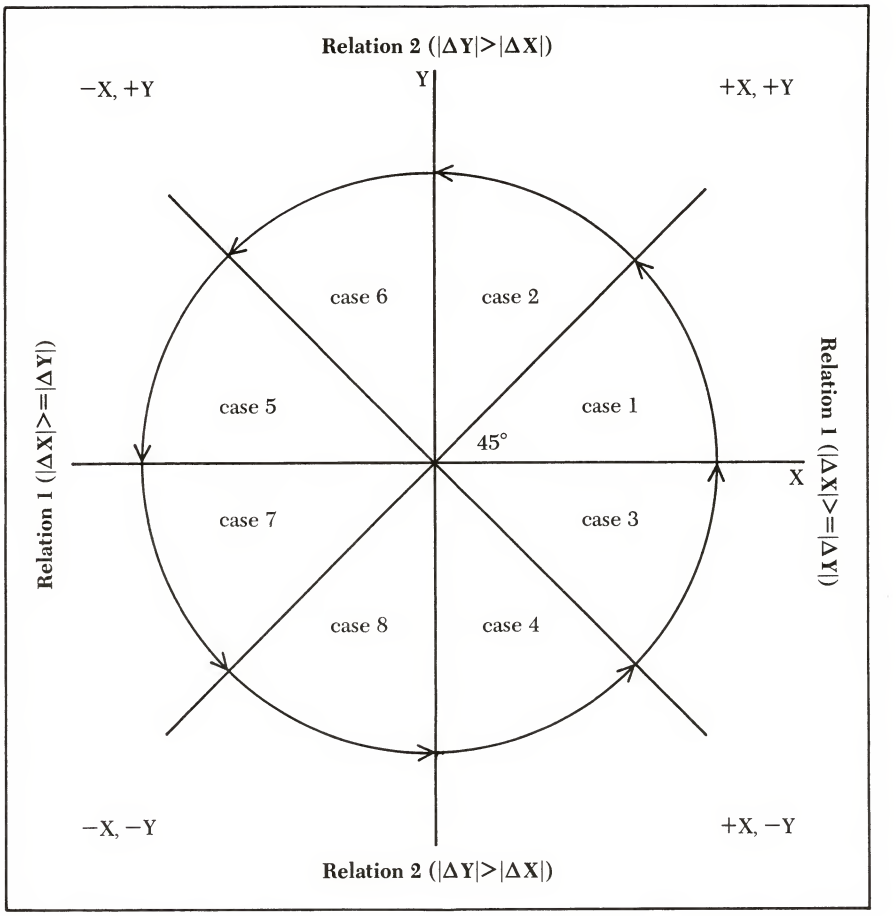

Figure 4. The eight cases of Listing 3's algorithm for handling straight lines. As an example, consider any straight line running at an angle of from zero up to 45 degrees (case 1). All dots along such a line would have positive values for their X and Y ordinates (X2 > X1, and Y2 > Y1). For such lines, moreover, relation 1 would be true: as each succeeding dot was drawn, the change in the value of the X ordinate (ΔX) would always be greater than the change in the value of the Y ordinate (ΔY). Eight cases are therefore produced by the possible combinations of the three parameters: X is positive or negative; Y is positive or negative; and the relation which holds is either relation 1 or relation 2. (Zero values of X and Y are joined together with positive values.)

Listing 2. An intermediate-level line-drawing routine. While technically correct, it contains several inefficiencies. It contains several tests and evaluations of the absolute-value function for each dot. These are eliminated in Listing 3.

```
procedure LINE2 (IX1,IY1,IX2,IY2:integer);
var
  DX, DY, DEV, X, Y: integer;
begin
  DX := IX2 - IX1;
  DY := IY2 - IY1;
  DEV := 0;
  X := IX1;
  Y := IY1;
  PLOT (X,Y);
  while (X <> IX2) or (Y <> IY2)
    do
      begin
        if abs(DX) >= abs(DY)
          then  {X always changes}
            begin
              if DX > 0
                then    {increment X}
                  begin
                    X := X + 1;
                    DEV := DEV + DY + DY
                  end
                else    {decrement X}
                  begin
```

```
                X := X - 1;
                DEV := DEV - DY - DY
              end;
          if abs(dev) > abs(DX)
            then    {changing Y will reduce deviation}
              if DY > 0
                then        {increment Y}
                  begin
                    Y := Y + 1;
                    DEV := DEV + DX + DX
                  end
                else        {decrement Y}
                  if DY < 0
                    begin
                      Y := Y - 1;
                      DEV := DEV - DX - DX
                    end
        end
      else  {Y always changes}
        begin
          if DY > 0
            then    {increment Y}
              begin
                Y := Y + 1;
                DEV := DEV + DX + DX
              end
            else    {decrement Y}
              begin
                Y := Y - 1;
                DEV := DEV - DX - DX
              end;
          if abs(DEV) > abs(DY)
            then    {changing X will reduce deviation}
              if DX > 0
                then        {increment X}
                  begin
                    X := X + 1;
                    DEV := DEV - DY - DY
                  end
                else
                  if DX < 0
                    then    {decrement X}
                      begin
                        X := X - 1;
                        DEV := DEV + DY + DY
                      end
        end;
      PLOT (X,Y)
    end
end  {LINE2};
```

erated, its reflections are generated. Each reflection is then translated from the origin by adding IX to the X ordinate and IY to the Y ordinate. Each translated dot is then plotted.

The initial dot generated is at (IR,0). This dot has deviation 0. The deviations will be tracked from there.

An intermediate-level circle-drawing routine is shown in Listing 1. It is presented in Pascal to emphasize the algorithm. (To improve the performance, it should be coded in assembly language.)

The procedure PLOT in Listing 1 is the low-level routine which turns on, turns off, or toggles a dot on the screen. If the PLOT routine is toggling dots on an axis, then redundant points cannot be generated.

The Line-Drawing Algorithm

As we will now see, I have used the same methodology to develop the algorithm for the line-drawing routine. This routine is not as simple as the circle-drawing routine due to the lack of symmetry. Instead of eight reflections, straight lines will be described by eight cases: one case to cover lines at angles from zero up to 45 degrees, another for 45 up to 90 degrees, and so on, covering the full 360 degrees possible. (See Figure 4.) Since the slope of a straight line is constant, the relationship of $|\Delta X|$ with $|\Delta Y|$ will be fixed for any given line.

Before proceeding, let us now recall the procedure header for the intermediate line-drawing routine.

```
PROCEDURE LINE2 (IX1,IY1,IX2,IY2:INTEGER);
```

The purpose of this routine is to compute the dots which best approximate a straight line from (IX1,IY1) to (IX2,IY2). Clearly the dot (IX1,IY1) will lie on that line and therefore will have deviation 0. The algorithm will start at (IX1,IY1) and work its way to (IX2,IY2) one dot at a time. The algorithm will generate the dots which minimize the deviation from the equation for the ideal line.

We will now obtain a deviation function using the methodology developed earlier. The first step in this process is to

Acknowledgements

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Steve Parker of the Heath Company for taking the time to discuss the methodology. Steve was especially helpful with the circle-drawing algorithm. He pointed out there were eight reflections which could be used instead of the obvious four.

Jim Abbott of the University of New Orleans Mathematics Department for reading the article and offering several valuable comments on the presentation of the methodology. Thanks to Jim, I was able to keep the math as simple as possible.

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Jean Troendle, my wife, for meticulously proofing this article and putting up with me.

obtain a suitable equation for the line. As in the circle-drawing equation, we will be looking for an equation which has only integer coefficients and constants.

The slope-intercept form is the usual method of representing the equation for a straight line. We will begin from there. The slope-intercept equation for a straight line has the form:

$Y = (\Delta Y/\Delta X) * X + B$

where: $\Delta Y = IY2 - IY1$

$\Delta X = IX2 - IX1$

$B = IY1 * \Delta X - IX1 * \Delta Y$

Note that ΔX, ΔY, and B are all integers. This equation is not in quite the form required because the coefficient of X, $\Delta Y/\Delta X$, is not necessarily an integer. This problem is easily fixed by multiplying both sides of the equation by a multiple of ΔX. We will multiply by $2*\Delta X$. While ΔX would have met the criteria for integer constants and coefficients, using $2*\Delta X$ will make the test for a reduction in deviation easier. The equation now has the form:

$2*\Delta X*Y = 2*\Delta Y*X + 2*\Delta X*B$

The final step in obtaining the deviation function is to re-arrange the above equation so that one side is 0. This is:

$2*\Delta Y*X - 2*\Delta X*Y + 2*\Delta X*B = 0$

Therefore, the deviation function is:

$f(X,Y) = 2*\Delta Y*X - 2*\Delta X*Y + 2*\Delta X*B$

The next step in the methodology is to find the deviation formulas. Unlike the circle-drawing routine, the direction of the change in X and Y depends on the slope of the line. This leads to four possible ways changes in X or Y could affect the deviation:

Change X by +1
change in deviation = $f(X+1,Y) - f(X,Y) = 2*\Delta Y$

Change X by −1
change in deviation = $f(X-1,Y) - f(X,Y) = -2*\Delta Y$

Change Y by +1
change in deviation = $f(X,Y+1) - f(X,Y) = 2*\Delta X$

Change Y by −1
change in deviation = $f(X,Y-1) - f(X,Y) = -2*\Delta X$

Two line-drawing routines will be presented. The first (found in Listing 2) will closely follow the methodology discussed earlier. While technically correct, this will have several inefficiencies. It contains several tests and evaluations of the absolute-value function for each dot. The second presentation of the line-drawing algorithm (Listing 3) uses eight cases to eliminate the absolute-value function and all tests (except the deviation-reduction test).

The line-drawing routine shown in

Listing 3. A second presentation of the line-drawing algorithm. This, however, is more efficient in that it eliminates evaluating the absolute value and eliminates most of the testing. This is done by breaking the algorithm itself into eight cases (procedures CASE1 through CASE8). These eight cases are also shown in Figure 4.

```
procedure LINE2 (IX1,IY1,IX2,IY2:integer);
var
  DEV, DX, DY, X, Y : integer;
procedure CASE1 {IX2 >= IX1, IY2 >= IY1, DX >= DY};
begin
  for X := (IX1+1) to IX2
    do
      begin
        DEV := DEV + DY + DY;
        if DEV > DX
          then
            begin
              Y := Y + 1;
              DEV := DEV - DX - DX
            end;
        PLOT (X,Y);
      end
end;
procedure CASE2 {IX2 >= IX1, IY2 >= IY1, DY > DX};
begin
  for Y := (IY1+1) to IY2
    do
      begin
        DEV := DEV + DX + DX;
        if DEV > DY
          then
            begin
              X := X + 1;
              DEV := DEV - DY - DY
            end;
        PLOT (X,Y);
      end
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```
end;
procedure CASE3 {IX2 >= IX1, IY2 < IY1, DX >= DY};
begin
  for X := (IX1+1) to IX2
    do
      begin
        DEV := DEV + DY + DY;
        if DEV > DX
          then
            begin
              Y := Y - 1;
              DEV := DEV - DX - DX
            end;
        PLOT (X,Y);
      end
end;
procedure CASE4 {IX2 >= IX1, IY2 < IY1, DY > DX};
begin
  for Y := (IY1-1) downto IY2
    do
      begin
        DEV := DEV + DX + DX;
        if DEV > DY
          then
            begin
              X := X + 1;
              DEV := DEV - DY - DY
            end;
        PLOT (X,Y);
      end
end;
procedure CASE5 {IX2 < IX1, IY2 >= IY1, DX >= DY};
begin
  for X := (IX1-1) downto IX2
    do
      begin
        DEV := DEV + DY + DY;
        if DEV > DX
          then
            begin
              Y := Y + 1;
              DEV := DEV - DX - DX
            end;
        PLOT (X,Y);
      end
end;
procedure CASE6 {IX2 < IX1, IY2 >= IY1, DY > DX};
begin
  for Y := (IY1+1) to IY2
    do
      begin
        DEV := DEV + DX + DX;
        if DEV > DY
          then
            begin
              X := X - 1;
              DEV := DEV - DY - DY
            end;
        PLOT (X,Y);
      end
end;
procedure CASE7 {IX2 < IX1, IY2 < IY1, DX >= DY};
begin
  for X := (IX1-1) downto IX2
    do
      begin
        DEV := DEV + DY + DY;
        if DEV > DX
          then
```

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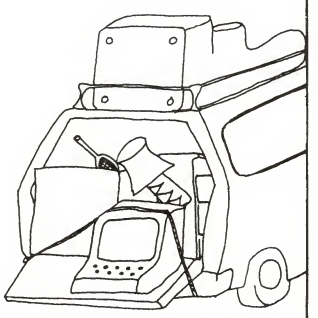

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```
            begin
              Y := Y - 1;
              DEV := DEV - DX - DX
            end;
        PLOT (X,Y);
      end
end;
procedure CASE8 {IX2 < IX1, IY2 < IY1, DY > DX};
begin
  for Y := (IY1-1) downto IY2
    do
      begin
        DEV := DEV + DX + DX;
        if DEV > DY
          then
            begin
              X := X - 1;
              DEV := DEV - DY - DY
            end;
        PLOT (X,Y);
      end
end;
begin   {LINE2}
  PLOT (IX1,IY1};
  DEV := 0;
  DX := ABS(IX2 - IX1);
  DY := ABS(IY2 - IY1);
  if IX2 >= IY1
    then
      if IY2 >= IY1
        then
          if DX >= DY
            then
              CASE1
            else
              CASE2
        else
          if DX >= DY
            then
              CASE3
            else
              CASE4
    else
      if IY2 >= IY1
        then
          if DX >= DY
            then
              CASE5
            else
              CASE6
        else
          if DX >= DY
            then
              CASE7
            else
              CASE8
end     {LINE2};
```

Listing 3 is equivalent to the one presented in Listing 2. However, the version in Listing 3 breaks the algorithm itself into eight cases to eliminate evaluating the absolute value and most of the testing.

Final Observations

To obtain the deviation formulas for higher-order polynomials, trial-and-error inductive techniques may have to be applied. For instance, consider the curve-defining equation:

$Y = X^3$

This yields the following deviation function:

$f(X,Y) = X^3 - Y$

With the above deviation function, the change in deviation caused by incrementing X is given by:

$f(X+1,Y) - f(X,Y)$
$= (X + 1)^3 - Y - [X^3 - Y]$
$= X^3 + 3*X^2 + 3*X + 1 - Y - X^3 + Y$
$= 3*X^2 + 3*X + 1$

The X^2 term looks as if it could cause a multiplication each time the deviation equation is evaluated. Instead of computing $3*X^2$ each time, keep track of $3*X^2$ by adding in the difference between $3*(X+1)^2$ and $3*X^2$ to $3*X^2$. This difference is $6*X + 3$. The initial $3*X^2$ will have to be computed. From there it can be tracked.

This process should seem familiar. It is the same technique used to obtain the formula for change in deviation. For higher-order polynomials, this process may have to be repeated several times. The purpose of this process is to eliminate multiplication for each dot.

For functions which cannot be represented as a finite polynomial, this methodology can still be employed. To use it, first obtain a polynomial approximation of the function and then use this method on the polynomial. Note that the polynomial approximation will not have to be very accurate. As long as the discrete dots have more error than the approximation, the approximation is good enough. This will tend to limit the order of the approximation polynomial.

The method presented here provides a straightforward approach to developing an algorithm for many curves. The method requires only integer arithmetic and a simple test for each dot generated. When coded in assembly language, it will produce dots at an impressive rate.

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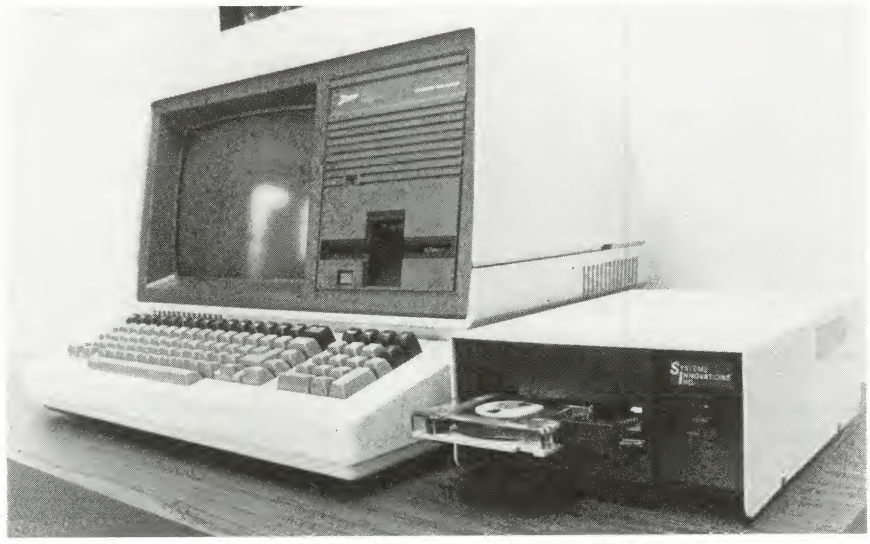

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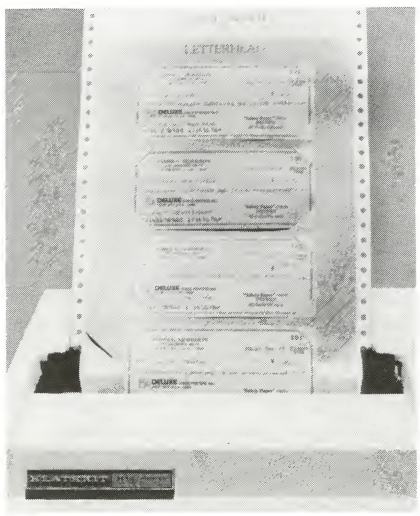

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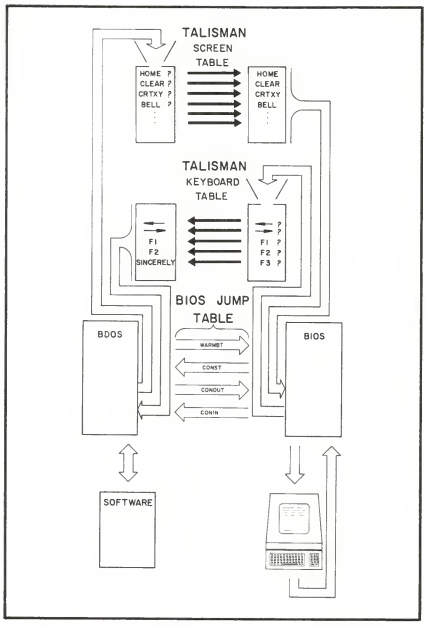
Talisman is a program which produces terminal compatibility. It lets any CP/M 80 software run on any CP/M microcomputer, regardless of what terminal the software was originally configured for, provided that it has the proper disk format. Talisman may be used with the H/Z89, Z90, H/Z19, and H/Z100, and supports all disk formats. When used with a communications package, Talisman can transform any microcomputer terminal into the correct terminal for any micro, mini, or mainframe computer. Talisman also lets the user reprogram the keyboard into any configuration, including complete phrase repeats of up to 249 characters with just one or two key strokes.

Talisman requires a minimum of 48K, CP/M 2.2+ operating system, and a disk drive with at least 90K storage. The program itself occupies 1K to 4K of memory. Talisman is available for CP/M 80 and multi-processor MP/M 80, and costs $125. To order, contact Disco-Tech, 600 B Street, P.O. Box 1659, Santa Rosa, CA 95402, 707/523–1600.



Talisman comes preprogrammed with control-code overlays for over seventy terminals. The program monitors all character I/O travelling through the CP/M BIOS in either direction, as the diagram shows. Talisman intercepts and analyzes any special characters or codes.

Key redefinition works the same way, but uses user-programmed translations.

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Luminaries

Thomas G. Bohon is a Captain in the Air Force, working in data processing. His experience includes systems and programming work on major mainframes. He also has an M.B.A. in Quantitative Methods from the University of Missouri. He's interested in the mathematical and statistical uses of micros—as well as getting them to do nice simple stuff like occasional correspondence.

Ralph W. Boyd is employed as a physicist in Miami, Florida, by the New York Institute of Technology. He works on the design of optical and acoustical systems, as well as developing computer programs. For his own business, he likes programming advanced computer games. If they're graphically challenging as well as interesting to the user, so much the better.

Charles E. Cohn is a physicist at the Argonne National Laboratory near Chicago. This is not the first time he's written for *Sextant* on sprucing up the use of Heath Company software. He took on HDOS stand-alone operation in #6, Summer 1983, and #9, March-April 1984.

Herbert A. Friedman is an M.D. from California. He doesn't restrict himself to the organizational aspect of Heath/Zenith computing. His *Pomona HUG News* article on the directory structure of the Heath Disk Operating System was carried in *Sextant* #5's special section on local HUGs.

Peter Norton has a vested interest in understanding what's going on in the Microsoft Disk Operating System. Besides writing a book about MS-DOS, he also writes programs for it. Well, the Norton Disk Utilities were written for MS-DOS as it looks when called PC-DOS. But as noted in Graham Wideman's article in *Sextant* #9, they'll also run under Z-DOS if they have some help from emulator software.

Robert W. Rasch chairs the Physiology Department at the Quillen-Dishner College of Medicine of Eastern Tennessee State University. So *now* you know why it was natural for him to find an example that talked about chimpanzees.

Thomas R. Sear has more than 30 years experience as both a technician and a technical writer. He put on both hats to write about the Trionyx motherboard in *Sextant* #5, Spring 1983. Since he's now added the new X/2-H8 board, we're entitled to assume that he's getting his H8 ready to rack up just as much experience as *he* already has.

David Troendle is associate director of the computer center at Louisiana State University's Medical Center. But he's better known to Heath/Zenith users as cofounder of New Orleans General Data Services. They're the folks who, among other things, brought out the first color graphics board for Heath/Zenith computers—so you'd have the hardware that could draw those circles and lines.

Take Advantage of Z-DOS Batch Files

Why tell your computer what you want it to do when it can find out for itself?

Peter Norton

Sextant *readers who are using the Zenith Disk Operating System (Z-DOS) may be interested in Peter Norton's new book,* MS-DOS and PC-DOS: User's Guide. *This guide is written for the user of any computer which, like the H/Z100, runs the Microsoft Disk Operating System, either version 1 or version 2. (Since there are a number of machines running MS-DOS, the book simply refers to "DOS.") The following material on using batch files is excerpted from Chapter 11.*

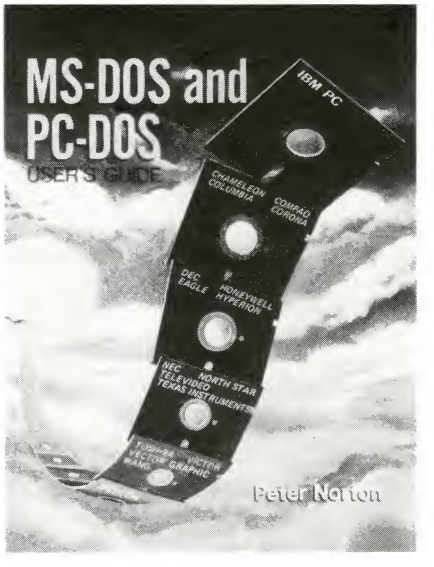
Batch processing files are one of the most useful and powerful features of DOS, and we'll take a look at them in this chapter. First, we'll cover the simple idea of what a batch file is, and then get into some of the fancier tricks of using batch files. Finally, we'll finish the chapter with some suggestions and examples to help you get the most out of batch files.

Introducing batch processing

The basic idea of batch processing is simple and ingenious: if you need the computer to perform a standard task, why should you have to key in the details of the task? Instead, let the computer be told what it is supposed to do by reading its commands from a file. With a batch file, DOS doesn't perform our commands extemporaneously—it reads from a script.

There are some interesting details on what a batch file can do, but first let's see the elemental part. Batch processing is always done with a "batch processing file," which must have the filename extension of ".BAT". The file must be an ASCII text file (which we described in Chapter 9) and you can create it with any ordinary text editor, such as the EDLIN editor that comes with DOS. You can also use a word processing program to create batch files, though you should be sure to check if your word processor needs any special instructions to create an ordinary ASCII text file.

Inside the batch processing file are ordinary DOS commands, just as you might enter them on the keyboard. There can be one or many commands in the file with each command on a separate line.



This excerpt is from the recently published book, *MS-DOS and PC-DOS. User's Guide* (Robert J. Brady Co., Bowie, MD, 1983). It is available at ComputerLands, B. Dalton Booksellers, Waldenbooks, Crown Books, and other bookstores and computer retailers. If you are unable to find this book, or any other Robert J. Brady Co. book of your choice, call toll-free 800/638-0220 for information.

You put a batch file to work by entering its filename without the BAT extension (although you could key that in if you wanted). This works exactly the same way that you use a program—you type in the name of the program, or the name of the batch file, and DOS goes looking for it. Whenever DOS's command processor encounters a command that isn't internal, it searches the appropriate disk for a file to carry out the command. The file could be a program file (with an extension name of COM or EXE), but if it turns out instead to be a BAT batch processing file, then DOS starts executing the commands held in that file.

Let's take a look at a very simple batch file to get an idea of how it works. Let's suppose we've created a file with a name of D.BAT. Notice that it has the proper extension of .BAT. Since the filename itself is D, then D is all that you would need to type in to invoke this batch processing command. Now the contents of this batch processing file might be something very simple, such as a single line that reads:

```
DIR
```

which, you probably remember, is the name of the directory command that lists the contents of a disk.

With this batch processing file set up, what would happen if we keyed in D and pressed *enter*? DOS would search for this batch file, and then start executing it. DOS would find just the one command, DIR, so it would just give us a directory listing.

This example is about as silly and as short as you could imagine. You might be thinking that it is a completely artificial example with no practical value. Surprisingly, no. There is a use for batch processing commands like this. What this command does, in effect, is let you use D as an abbreviation for DIR; that may not seem like a big deal, yet it cuts the keystrokes you have to type in half, from four to two (counting the *enter* key). This is one of the main purposes of batch files—to simplify the typing you have to do to get your computer to do some work for you. One of the best uses of batch files is simply to provide convenient abbreviations of commands.

One of the rather clever things that DOS does is to keep track of where it is working in a batch file. When the file has more than one command, DOS knows how to carry on. When each command is finished, DOS searches for the file, reads past as many command lines as it has processed, and then starts the next command.

Saving time and trouble

Why would you want to have batch processing files? We've already seen one reason—to create an abbreviation for a command name. There are two

```
COPY DATA.NEW   DATA.OLD   make a safe copy of our old data
PROCESS         DATA.NEW   use a program that creates new data
DIR             DATA.NEW   check the directory for info on new
                           data
PAUSE   If all is well, delete old data, otherwise, press BREAK
DEL             DATA.OLD   discard old data
```

Listing 1. One of the uses of PAUSE is safety.

other good reasons, even before we get into the advanced stuff.

The reason for using batch files that you have probably anticipated is the most important one: grouping several commands into one functional unit. Very often you need to do several things to carry out one task. For example, to write the very words you are reading, I used a batch file which has four steps: the first runs my text editor program, so that I can type in these words; the second checks what I have written for spelling errors; the third runs my editor again so that I can correct the spelling errors; and finally, the fourth makes a backup copy of what I have written onto another disk.

I could, if I wished, do each of these four steps separately, however I chose to run them. But putting them all into one batch processing file has done two very useful things for me. First, it has saved me the trouble of invoking each step by itself. Second, and more important, it has established a standard operating discipline: each time I write, I will check my spelling and I will make a backup copy. Laziness won't keep me from doing those two important tasks.

So the most important reason for using batch files is to gather together, under one name, all the separate steps needed to perform a unified task. The reason for doing that is as much for uniformity and completeness as it is for convenience and ease.

Finally, there is one more key reason for using batch files, besides abbreviation of commands and combinations of commands. That reason is safety. If you don't know it already, there are some maddeningly dangerous commands available to us in DOS. These are the commands that can wipe out our data in the blink of an eye. There are three such dangerous commands: DEL/ERASE, which discards data; COPY, which can overwrite good data with bad; and FORMAT, which can wipe out the entire contents of a disk, beyond all hope of recovery. Batch files can reduce the danger of using these commands.

Let us suppose that we routinely need to ERASE a file called DATA.OLD, while preserving the file DATA.NEW. If you have to type in the command:

ERASE DATA.OLD

there is just a little chance that one day, absent-mindedly, you will type in NEW rather than OLD. Wouldn't that put you in a pickle? But if you had a batch file with that ERASE command in it, you won't have to worry about that kind of mistake. In fact, you might have a batch file which safely and reliably ERASEd all sorts of files without a worry—because if you got the batch file built right, then the commands would go right each time. Never a slip. You might even name that batch file something evocative and easy to remember, like KILL-OLD. Remember that if KILL-OLD is to be a batch command, then the file that defines what it does must be named KILL-OLD.BAT.

REM and PAUSE

There are some commands built into DOS that are there just to make batch file processing better. Two of these are the REMark and PAUSE commands. REMark, of course, is intended to let you put comments into a batch file—the REM comments can say, "this is what I'm doing." The PAUSE command is just another form of the REM command, but it suspends the operation of the batch file until a key is struck.

The PAUSE command is good for two purposes—one is to keep some useful information from rolling off the screen. With a PAUSE command, you have a chance to look at what is on the screen for as long as you want before the computer carries on its work. The other use is for safety. If a batch file is about to do something that might endanger some of your data, then a PAUSE to check that everything is in order is a very good idea. This can be particularly valuable before a command that might ERASE or COPY over your data.

If you use the PAUSE command in this way and decide that you don't want things to carry on, how do you stop them? The break command, also called CONTROL-C, will stop the operation of the batch file so that it will not carry on to whatever it was going to do. On some computers there is a special key for the break command, while on others it is just entered by holding down the CONTROL key and pressing the C key. Either way, CONTROL-C or break is what you use to stop a batch file from carrying on—and the PAUSE command gives you the opportunity to do it at the right moments.

[Listing 1] is a dummy example of how PAUSE might be used for safety.

This example is, as we said, a little artificial, but the ideas are ones that you will probably want to use. Notice that DIR is used to take a quick look at the new data—it will show us both the size and the time stamp on the new data file, which ought to be enough to tell us if the PROCESS program was successful in creating the new data. If everything looks good, we proceed from the PAUSE statement to clean things up by deleting the copy of the old data. If things *aren't* all well, then we break at the PAUSE so that the old data isn't deleted, and we can try to fix whatever went wrong.

What we've seen so far makes batch files look very useful. But what you can do with them is even richer and more useful than you have seen so far, as we'll see in the next section.

Slightly more advanced batch processing

You'll remember that I mentioned that I used a batch file to help me write this chapter. The name of the file might be WRITE.BAT, and, simplifying things a bit, the contents of that batch file might be like this:

```
EDIT CHAPTER.11
SPELL CHAPTER.11
EDIT CHAPTER.11
SAVE CHAPTER.11
```

But there is something drastically wrong with this batch file: it only works for Chapter 11. I would need to change it to work on any other chapter, which would be pretty stupid. The solution? Parameters. When I invoke the batch file, instead of just entering the batch command

WRITE

I would give a parameter, indicating what chapter I wanted to work on:

WRITE 11

Meanwhile, inside the batch file WRITE.BAT, everywhere the chapter number was needed, the batch file would have a special symbol, "%1", which would tell DOS to substitute the parameter that I had entered. Our batch file would look something like this:

```
EDIT CHAPTER.%1
SPELL CHAPTER.%1
EDIT CHAPTER.%1
SAVE CHAPTER.%1
```

There can be more than one parameter, so a digit is used after the percent sign (%), to indicate which parameter is used. %1 is used for the first parameter after the command name, %2 for the second, and so on, for up to nine parameters. (If you need anywhere near that many, you're probably making things much too complicated.) Parameter number zero, %0, is used to get the name of the batch command but there isn't much point in that.

There are some more things to know about batch files in general. Inside a batch file are commands—which could be program names or other batch file commands. If the command is a program, then when that program is done we can carry on with the batch file. But if the command is the name of a batch file, then control never comes back to the original batch file. In technical terms, this means that batch files are *chained* but not *nested*. If batch file A invokes

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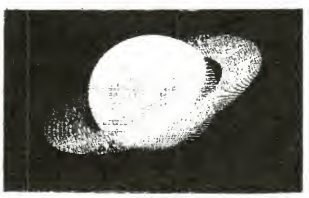

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batch file B, when B is done things stop; they don't carry on where A left off.

One of the batch commands that could be in a batch file is the file's own name. A batch file can invoke itself, starting an endless repetition of the same work done over and over again. This can be very useful when you have to repeat some operation. The break command, commonly called CTRL-C, can be used to break out of this endless repetition. Putting a PAUSE command just before the repetition starts can be a good idea.

It is also possible for a program to control its own destiny by writing out the contents of a batch file that will be executed when the program is done. This is a very clever mechanism that makes it possible to use the full, rich logical capabilities of a programming language to decide what commands are to be carried out next. This is done like this: we create a batch file, let's call it A, which runs our program; following the program, our A batch file tells DOS to carry out a batch file named B. But the program that is run by the A batch file itself creates the file B.BAT—so the program decides what is to be done when it finishes. The program in the A batch file creates whatever exact instructions are to be performed in the B batch file.

If you go in for this sort of trick, test your work carefully and beware of certain traps. For example, it is much safer for a program to create the next batch file that will be executed than try to change the batch file that is currently being performed.

. . .

Batch file tricks

Let's start this discussion of the uses of batch files with some philosophy—the philosophy of the black box. Roughly speaking, there are two ways of using a personal computer: expert and dumb-dumb. Experts know what they are doing (or think they do), and they usually enjoy being involved in the mechanics of how work gets done. Us dumb-dumbs don't really know what's going on, and probably don't care—we want the results and don't care to get involved in the mechanics of how it's done. For dumb-dumbs, computer operations need to work like what is called a black box; we don't need to see how the box gets its work done, as long as we are confident it is doing the work correctly. While it is very nice to have an expert's technical knowledge, for most users of computers the more the computer is a trustworthy black box, the better.

One of the features of DOS which can help make it work like a friendly black box is batch file commands. My reason for explaining this so elaborately is to instill in you the idea that batch files are more than just a convenient, efficient, and safe way to direct the computer's operations. Batch files are also a key way of building black boxes to help make the use of your computer less technical. When you understand this idea, it can guide you into making the best possible use of batch files. The key thing in making batch files work like black boxes is to write them in a style which makes them work as smoothly and as unobtrusively as possible.

. . .

Two of the most useful things you can put into batch files are remarks and pauses, using the REM and PAUSE commands. It is surprisingly easy to lose track of exactly what you are doing. That sounds really dumb, but it's true—especially if you are doing the same thing over and over again. If you are, say, working your way through a list of files, then you might lose your place in the list. That problem can be solved by using the REM command to show you the parameters that your batch file is working with. Example? All my batch files that run my text editor end with this REM:

```
REM Was editing the file named %1
```

And, of course, the parameter %1 shows me the file name.

The same thing can be done with the PAUSE command, but PAUSE has some extra advantages. If you are running something lengthy and automatic through a batch file, PAUSE can be used to suspend the operation so that you see the current screen display, and also decide whether or not to proceed with the rest of the batch file. If you don't want things to proceed, the *break* key will shut down the batch file command.

Pausing for approval to continue is a very important part of any batch file that does anything potentially dangerous. For example, you might have a series of programs which deliberately leave their work files on disk so that you can recover the data if anything goes wrong. In a batch file like this, you could have the last step of the batch file ERASE the files and then you could put a PAUSE just before the ERASE, giving you a chance to check that everything was all right before the files were destroyed.

On the subject of the ERASE command, if you use ERASE/DEL in a batch file it's a good idea to put a DIR command right before it so that you see a list of the files that are about to be erased. This is a nice safety feature since it keeps you in the know.

There are some commands in DOS which are very useful to use that are a nuisance to type in. With batch files, you can use them liberally with no effort at all since the batch file does all the work for you. One of the most important is the check disk command, CHKDSK. CHKDSK is useful to put in your batch commands for two reasons. First, it lets you know how much working space is left on your disk—and it is useful to see that often, so that you get early warning about running out of space. CHKDSK also inspects the disk for some logical damage (meaning scrambled data but not physical damage) on the diskette, and it's a good thing to do that frequently, even though the scrambling isn't a common occurrence.

It is also quite handy to add the DIR command to most of your batch files. You can put in a specific command (indicating what files you want to know about) to see things like the file size and the files' date and timestamp. Examples: DIR %1, DIR *.BAS. You can also use the show-me-everything form of the DIR command just to see what's on the disk you are using. If you usually have a lot of files, the . . . "/W" switch, which is an option of the DIR command, will list them across the screen so that they take up fewer lines. Example:

```
DIR*.*
DIR*.*/W
DIR
```

. . .

Since the real magic of using batch processing files comes from tailoring them to your own needs, our suggestions and examples can only scratch the surface of the possibilities, and can only hint at some of the things that you can accomplish on your own through the creative use of batch files.

There is almost nothing in the use of DOS that will reward your efforts like the rewards of speed, convenience, and safety that you can gain by making full use of batch files.

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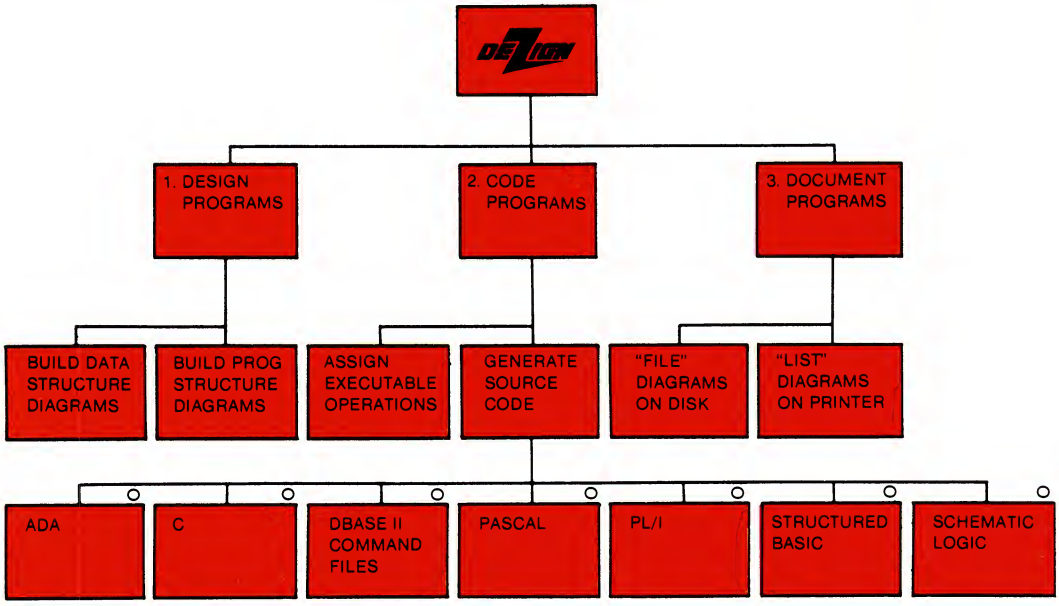

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JSP is described in "Principles of Program Design", by Michael Jackson, Academic Press.

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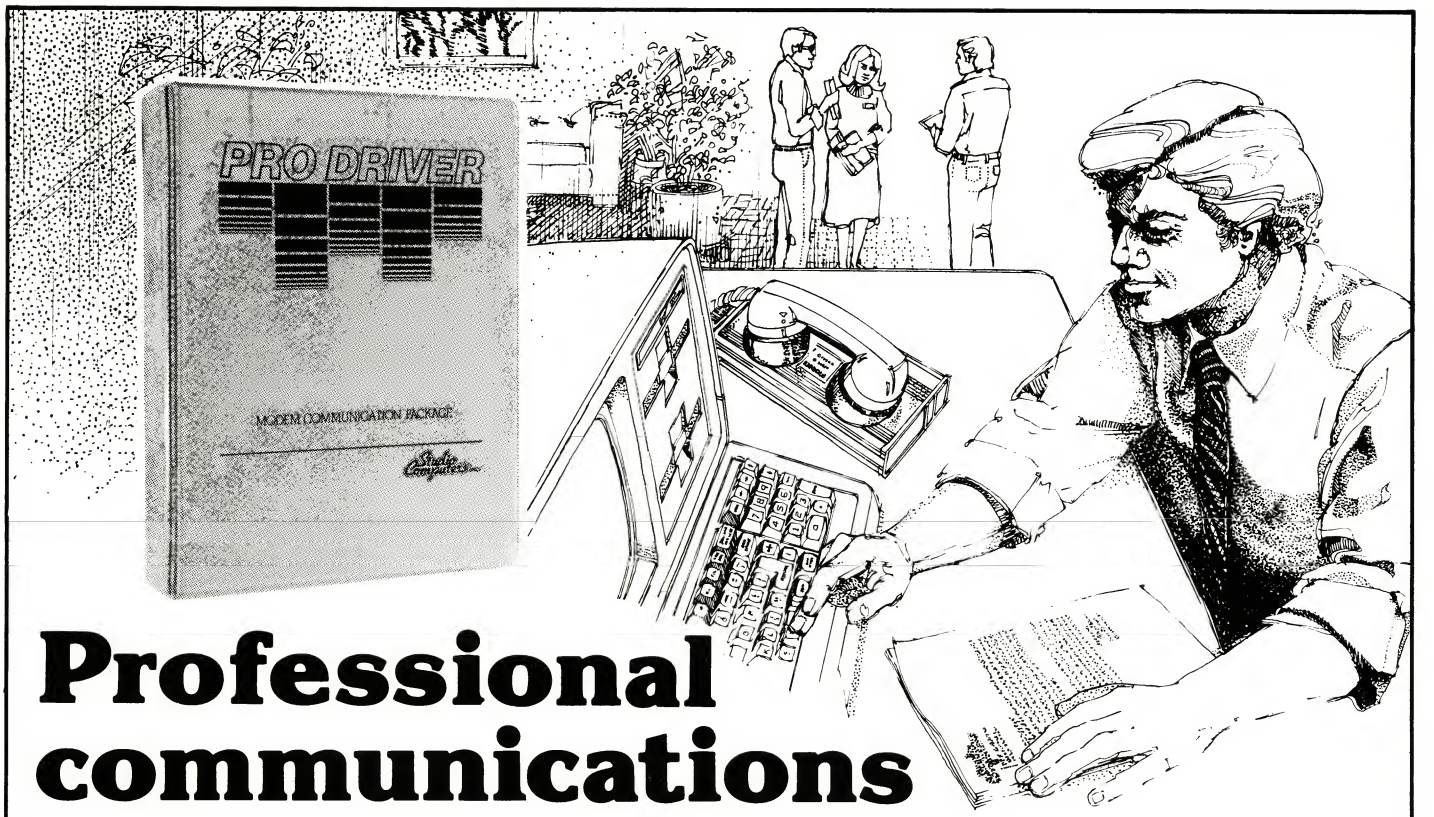


Professional communications

Pro Driver is a new professional communications package for Z100 computers using the ZDOS operating system. It allows you to 'talk' to remote computers using any modem or directly to another computer through a 'null modem cable', and allows transmitting and receiving of both ASCII and binary files. Pro Driver lets you perform operating system commands such as renaming files, deleting files, directory listings or resetting disks. The clear, uncluttered menu-driven displays make using Pro Driver a pleasure.

Here are just some of Pro Driver's features:

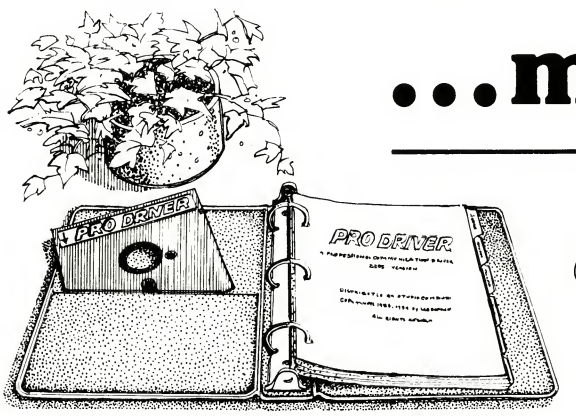
- Menu-driven request and control options
- Direct support for Hayes Smartmodems
- Report Generator for detailed tracking of calls
- XMODEM, Compuserve B and X/ON X/OFF protocols
- 32 User-Definable Automatic Logon Sequences
- Printer Trace function for hardcopy of all data
- User-Definable Control Sequences within Pro Driver
- Selectable Baud rates from 45 up to 19,200
- Configurable entry and exit foreground/background colors, cursor modes and keyclick options
- Help files for quick assistance on Pro Driver functions
- Detailed documentation of all functions

Pro Driver is a professionally designed package from top to bottom. Simple to operate even for the novice, yet with many features an experienced computer user would demand. For example, the 'Reporter' feature not only logs all calls made and the length of time per call, but gives you the option of outputting your report to a printer, a disk file or the video console. And, you can have that report sorted by telephone number or dates! Imagine being able to quickly check at the end of a week, month or even year just how long you spent connected to any specific time-sharing or bulletin board service. A great way to verify the connect-time bills they send to you!

Pro Driver comes with over 180 pages of documentation and pictorial screen displays, but don't let that scare you. Pro Driver is easy to operate! All major sections are organized with tab dividers for quick locating. And a complete index is also included.

The price? Just $49 for the entire package with all of the above features and more. Pro Driver may be purchased at our retail store location, by mail (please add $2 for shipping) or check your local Heathkit Electronic Center for availability.

Pro Driver — the ''professional'' communication interface for your Z100 computer.



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ZENITH data systems

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Scuttlebutt

According to one well informed member of the Capital Heath Users' Group, there will be a **special programmers' package for Z-DOS 2.0** for the Z100. Among the extras it will include is a "very slick new editor" called BSE.

Want more speed out of your Z100? Zenith is also working on a new motherboard which will enable the Z100 to run at **8 MHz**.

Need more room on your screen for those big spreadsheets? Zenith is working on a **132-column terminal**.

Zenith has not been doing very well in selling Z100s to the **scientific instrumentation** market, according to Jack McKay of the Naval Research Laboratory. He explained the situation in a series of messages on CompuServe's HUG bulletin board. Various independent manufacturers sell analog-to-digital and digital-to-analog (**A/D/A**) plug-in boards which should work with the Z100's S100 bus, but there's **no software support** available. Meanwhile, there is very strong peripheral and software support available for the IBM PC, which is apparently establishing itself as a de facto standard in the scientific instrumentation market. Consequently, McKay says, "the Z100 is making absolutely zero penetration" at the Naval Research Laboratory.

The Z100 is available to the Navy and the Air Force with greater capabilities and at a better price than the IBM PC. But if there's no software support for A/D/A interfacing, the Z100 won't get the recognition it deserves in the Navy/Air Force "vertical market" for scientific instrumentation. **Programmers, take heed.**

The first **Western Regional HUGCON** will be held on Saturday and Sunday, November 10 & 11, at the Disneyland Hotel in Anaheim, California. The grand prize at Saturday's dinner will be a Z100 with Winchester hard disk drive. Two days' registration, plus dinner Saturday, will cost $25. (Western Regional HUG, Attn: Herb Friedman, 1555 North Orange Grove Avenue, Pomona, CA 91767.)

The **Third International Heath Users' Group Conference** will be held at Pheasant Run Resort in St. Charles, Illinois, on the weekend of July 27–29. Pheasant Run is about 45 minutes away from Chicago's O'Hare airport. There will be a wide variety of recreational opportunities for you and your family, including **golf, tennis, shopping, and a dinner theatre**. Further information is available from HUG. (Hilltop Road, St. Joseph, MI 49085, 616/982–3463.)

By the way . . . is it too much to hope that Heath/Zenith will make another announcement about **HDOS 3.0** before HUGCON 3?

Well, Zenith has introduced its new IBM PC-compatible computers, the Z150 and Z160. It looks as if these **clones** will offer a very high degree of compatibility with software written for the PC.

A number of readers have called to ask **how compatible the Z150 will be** with the Z110 and Z120. The answer is that since the Z150 is a near-perfect "clone" of the IBM PC, the Z150 is compatible with the Z110 and Z120 to the precise degree that the Z110 and Z120 are compatible with the IBM PC—i.e., **not very**. You should be able to read from and write to Z150 disks in your Z110 or Z120, and vice versa. Z150/IBM PC software still won't run on your Z100. Nor will Z100 software run on your Z150.

One of Zenith's best customers for the Z100 summed up his reaction to the Z150: "**A wonderful implementation of a rotten machine.**"

While watching "**The A-Team**" one Tuesday evening, a member of *Sextant*'s editorial staff (who declines to be identified) saw a Zenith advertisement which mentions the new "Z100 PC" (a.k.a. the Z150). A pre-Z150 version of the same ad was seen on another prime-time classic, "Manimal." Considering that Zenith prides itself on being a "**high-tech**" company, its advertising seems to go for some pretty **low-brow** demographics. Although the strategy does seem to be reaching some of us here at *Sextant*. . . .

Zenith says that the Z160, their new IBM-compatible portable computer, should be available late this spring or early this summer. The disk drives are mounted in a unique "pop-up" housing. The display is a 9" amber screen. The keyboard includes a larger RETURN key and a more conveniently placed left-hand SHIFT key than on the IBM PC.

Alas, the unit weighs in at **a dainty 33 pounds**. Staff Writer Frederick Zimmerman comments that he has already extended his right arm two inches as a result of lugging around his virtually prehistoric 26-pound Osborne I. (To be fair, the Compaq, another **boxcar-style** transportable PC-compatible, weighs in at 28 pounds.)

Prices: $2,799 for the Z160 with one disk drive; $3,199 for the Z160 with two disk drives. MS-DOS versions 1.25 and 2.0 are included with the machine. (Version 1.25 is necessary in order to run some software written for the IBM PC.)

S-A Design Books of Brea, California, which published Hal Glatzer's *How to Use: Zenith/Heath Computers* in 1982, has just published ***The* FlipFast *Guide To: Zenith/Heath CP/M-80/85***, by William M. Adney. It's a handy size, about 5" × 8", which makes it a lot more convenient to keep next to your computer than the two gigantic three-ring binders in which Zenith provides the standard documentation for CP/M-85. **Expected this summer:** a ***FlipFast* guide to Z-DOS**, also by Adney.

Heath/Zenith Users !
Programmers ! Authors !

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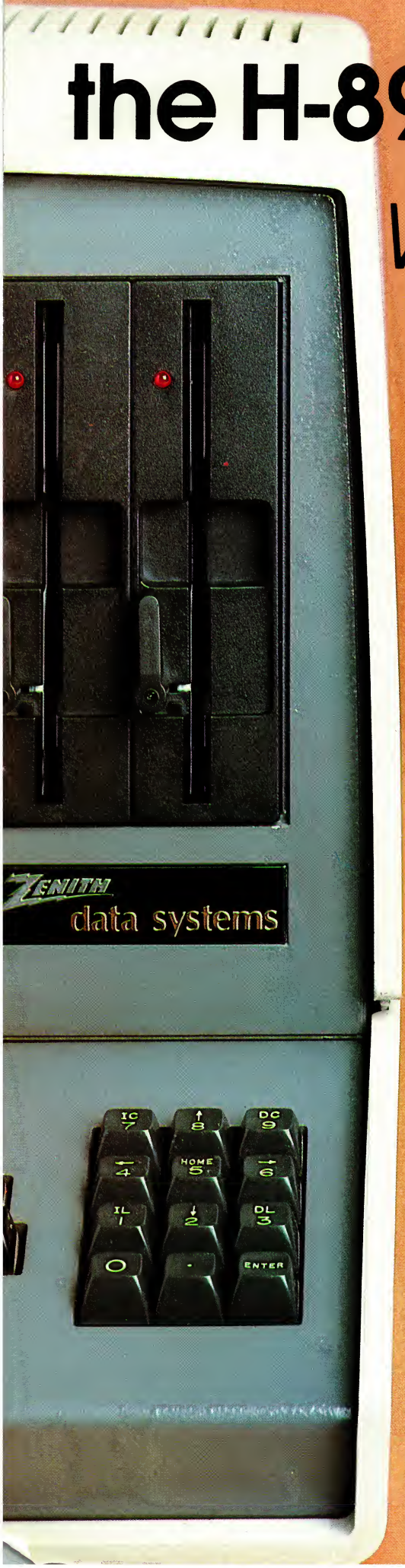

We've got a great idea for your H-88, 89 or 90. It's a dual *internal* half height drive system. Two of our half height 5¼" drives can replace your built-in disk drive, doubling your information storage capacity.

Floppy Disk Services provides you with everything you need. That's two double-sided, double or single density, half height drives in either 48 or 96 tpi format, all hardware, cables and power connector adaptors. And most important, you get easy, step-by-step instructions, in the Heath/Zenith tradition of good, clear documentation.

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Complete documentation

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Wondering what to do with your internal drive if you buy this system? Here's the solution. If you purchase a dual half height system for your Heath computer from Floppy Disk Services, just include an extra $50.00 plus shipping and receive a single 5¼ case with power supply *and* data cable ready to receive your SIEMENS internal drive! The case with data cable is normally a $70.00 item. And the cable that comes with your TWOET system includes the external chassis disk I/O connector.

Due to production deadlines, prices in this ad are 2 months old, so we encourage you to call us for current prices and new product info. Prices and specs subject to change without notice.

Dealer inquiries invited.

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